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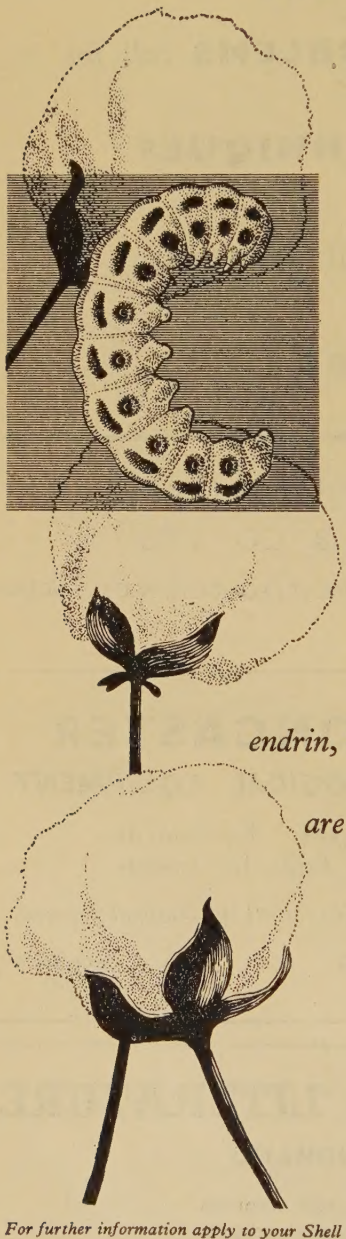

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Olsson (K.). **Äppelkärnstekeln.** [The Apple Seed Chalcid.]—*Växtskyddsnotiser* **21** (1957) no. 4 pp. 58–64, 6 figs., 4 refs. Stockholm, 1957.

Adult Hymenoptera that emerged in July 1956 from misshapen apples that fell in 1955 from trees in an orchard in southern Sweden on which such fruits had for years been common were identified as *Torymus* (*Syntomaspis*) *varians* (Wlk.) by Eady, who stated that *T. druparum* Boh. is a synonym of it, though the synonymy has not been published. The bionomics of this Torymid are reviewed, largely from the literature [*cf. R.A.E.*, A **43** 157]. Infestation in the orchard occurred on one variety only, though another was interplanted with it. In a small-scale test on control, the percentage of fruits attacked was reduced from 62 for no treatment to 34 by a spray of 1 per cent. of an emulsion concentrate containing 25 per cent. DDT.

Popov (P.). **Contribution to the Biology, Ecology and Prognosis of *Hyponomeuta malinellus* Z. in Bulgaria.** [*In Bulgarian.*]—*Selsk. Mis.* 1956 pt. 9 suppl. (*Nauch. Trud. Minist. Zemed.* Ser. Rast. **1** pt. 4) pp. 21–36, 1 fig., 20 refs. Sofia, 1956. (With Summaries in Russian and English.)

Hyponomeuta padellus malinellus Zell. is a serious pest of apple in Bulgaria, and observations in 1951–55 showed that it occurs throughout the country; it caused heavy losses in south-western districts in 1954–55, when the trees were defoliated over wide areas. The adults are usually present from mid-June until the end of August, but persisted until almost mid-September in 1954. The females laid 152 eggs each in masses, the number of larvae developing per mass ranging from 10 to 81. The larvae hatch in about a month, generally in early August, and overwinter at the hatching sites without feeding. They become active in spring and mine the leaves for 7–10 days, after which they feed externally in nests enclosing several leaves, this stage beginning usually in early May and continuing for a month or more, after which they pupate. The pupal stage lasts about a fortnight.

Mortality during the winter was found to average about 10 per cent., and was apparently not caused by cold, since larvae collected in February and March and exposed to a temperature of −21°C. [5·8°F.], which is far lower than would be encountered in the field, showed only 20 per cent. mortality after two days and did not all die until the exposure was prolonged to 14 days. Experiments in which larvae that had formed nests were kept at different temperatures showed that the thresholds of development were 8·1, 6·3, 8·25 and 9·8°C. [46·6, 43·3, 46·9 and 49·6°F.] for the second, third, fourth and fifth instars, respectively. The duration of development was dependent on temperature, and observations made in 1953–55 are recorded in tables; dry conditions were preferred, and rain was prejudicial to the pupae. The larvae were attacked by 14 species of parasites and by various predators, lists of which are given, and the percentages destroyed by insects in different years and districts ranged from 20·6 to 66·6. The degree of infestation can be forecast by observations on temperature in June–August, rainfall during and after the larvae have pupated, the numbers of egg-masses laid per tree, and the frequency of natural enemies.

Lyubenov (Ya.). **The Effect of Fertilisers and Sowing Date on the Degree of Attack by *Lema melanopa* L.** [*In Bulgarian.*]—*Selsk. Mis.* 1956 pt. 9 suppl. (*Nauch. Trud. Minist. Zemed.* Ser. Rast. **1** pt. 4) pp. 37–48, 1 graph, 22 refs. Sofia, 1956. (With Summaries in Russian and English.)

The larvae and adults of *Lema melanopa* (L.) cause much damage to cereals in Bulgaria by feeding on the leaves. Observations in 1952–55

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showed that oats and spring barley are preferred by this Criocerid, but that crops sown early (between 20th February and 20th March) are little or not at all attacked, since the leaves have passed the susceptible stage before infestation is possible, whereas those sown late are heavily damaged. Infestation was favoured by nitrogenous fertilisers, which led to tall, sappy growth and thin cell walls, and reduced by potash and phosphorous compounds, which led to thickening of the leaf cuticle and a general strengthening of the plant tissues.

Dobson (R. M.) & Lofty (J. R.). **A simple Cage for confining small Insects during experimental Exposure to Fumigants, etc.**—*Ent. mon. Mag.* **92** no. 1104 pp. 157–158, 3 figs., 1 ref. London, 1956.

A cage consisting of two brass washers held face to face by means of a rubber band and having fine phosphor-bronze gauze soldered to the outer side of each was successfully used during investigations on the effects of low humidities on newly hatched larvae of *Psylliodes chrysocephala* (L.). It is also suitable for confining small insects during experimental fumigation.

Rasmussen (S.). **Nutritional Preference Experiments with Larvae of House Longhorn Beetle,** *Hylotrupes bajulus*.—*Oikos* **7** fasc. 1 pp. 82–97, 7 figs., 4 refs. Copenhagen, 1956. **On the Significance of Cholesterol and Yeast Extract in the Diet of Larvae of House Longhorn Beetle** (*Hylotrupes bajulus*).—*T. c.* fasc. 2 pp. 243–250, 2 figs., 6 refs.

The experiments described in these two papers on the nutrition of *Hylotrupes bajulus* (L.) were carried out to amplify the results reported in one already noticed [*R.A.E.*, A **40** 15]. Sheets of pine veneer or filter paper impregnated with different concentrations of peptone, alone or with the addition of yeast extract, were formed into blocks for the tests recorded in the first paper, and the larvae were inserted into holes bored in the blocks, which were then kept between glass plates at 27°C. [80·6°F.] and about 85 per cent. relative humidity. The results showed that the nutritional value of the media increased with the concentration of peptone, and was improved by the addition of yeast; both effects were much less noticeable in paper, which is lacking in other vitamins, and mortality was higher in paper than in wood. The larvae tended to prefer the highest concentration of peptone (nominally 8 per cent.).

In the further tests described in the second paper, only filter paper impregnated with peptone and yeast was used, and cholesterol was added for comparison. When it was absent, the larvae did not increase their growth rate with increasing concentrations of peptone, ceased growing after 3–4 months, although not yet fully developed, and showed signs of nutritional deficiency. These symptoms did not appear when cholesterol was present, and a subsequent test showed it to be an essential growth factor for the first-instar larvae. The degree of utilisation of the food was not affected, so that the results must have been due to increased consumption.

Lizer y Trelles (C. A.). **Nuevos ensayos para combatir la chicharra de la yerba mate** *Fidicina mannifera* **(Fab.).** [New Tests on the Control of *F. mannifera* attacking Maté.]—*An. Soc. cient. argent.* **164** no. 3–4 pp. 81–86, 2 refs. Buenos Aires, 1957.

The author summarises the results of tests in 1955 on the control of nymphs of *Fidicina mannifera* (F.) on maté tea [*Ilex paraguensis*] in

Argentina [*cf. R.A.E.*, A **45** 111] and gives those obtained with systemic insecticides in 1956. Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] and Metasystox [dimethyl 2-(ethylthio)ethyl phosphorothioate (methyl-demeton)] were applied to the trunks in bands 8 ins. wide and covered with cellophane, and Isolan [1-isopropyl-3-methyl-5-pyrazolyl dimethylcarbamate] was applied in a similar way in a mixture of vaseline and lanolin or by inserting cotton-wool soaked in a 0·5 or 1 per cent. solution into cuts in the root-collar and wetting it again with the solution after a day. None of these treatments afforded control.

WALLACE (C. R.). **Report on an Investigation of the Paddy Bug in British Guiana.**—[1+] 119 pp., 10 pls., 1 fig., 2 col. fldg. maps (in pocket), 46 refs., multigraph. [London] Colon. Off., 1957.

In view of reports of damage to rice crops in British Guiana by *Solubea poecila* (Dall.) [*cf. R.A.E.*, A **23** 200], which sucks the developing grains, the status and control of this Pentatomid were investigated there during 1952–54. This detailed account of the results consists of nine sections, of which the first is introductory, the second comprises a survey of the methods used in rice cultivation, which is confined to a narrow coastal strip, and the organisation of the industry in British Guiana, and the third is a discussion of the damage attributed to the bug. This comprises reduced yield, since many grains fail to develop, a dark discoloration of the grains, and a tendency for them to become brittle, so that they crumble during milling. The rice is graded according to the proportion of discoloured and broken grains present, but the extent to which discoloration alone contributes to a lowering of grade is not apparent from the figures. Loss of yield appears usually to occur in only one or two localities in a year and in years of heavy infestation to be widespread or sporadic in only one or two districts, but monetary losses due to discoloration are considerable in one year in two. Other causes of reduced weight or discoloration of the grain are discussed in the fourth section and comprise natural sterility, attack by Lepidopterous stem-borers, birds and fungi, drought and other factors affecting the physiological condition of the plant, and the use of seed stocks including strains with pigmented grains.

In field tests described in the fifth section, plants heavily infested during the 15–16 days prior to harvest produced significantly more light-weight grains, rather more chaffy material and less usable unhusked rice than uninfested plants, and the correlation of infestation with dark discoloration and brittleness of the grains was confirmed. Evidence provided by the literature and local opinion as to the distribution and importance of reduced yields and discoloration due to infestation by the bug is reviewed in the sixth section, and the results of work, largely in Demerara, on the ecology and bionomics of *S. poecila* are given in the seventh. It was found on rice and immediately adjacent grassland only when the ears were present (between mid-February and mid-April and throughout August–October in Demerara and a month later in each case in Essequibo), but it was found on bamboo grass (*Hymenachne amplexicaulis*) at various places in March, May–June and September–December, on out-of-season rice crops in May and June, and on *Leptochloa virgata*, *Panicum geminatum* and *Paspalum conjugatum* [*cf.* also **41** 12] in coconut plantations and elsewhere and was reported to occur occasionally on sugar-cane. In the rice-fields, populations varied greatly from day to day, probably as a result of migration to rice in the most favourable stage; an adult was observed to fly for a distance of at least 50–60 yards. Mating took place during March–April and August–October.

Egg masses were normally deposited singly, but were sometimes concentrated in aggregations, and, towards the end of the rice crop, the progressive hardening of the grain sometimes caused adults to congregate in restricted areas. The eggs were parasitised, heavily in the autumn of 1952, by *Telenomus mormideae* Costa Lima, and the adults by *Beskia* sp. Outbreaks are commonest to the east of the Demerara River; they seem to be correlated with the presence of large tracts of *H. amplexicaulis*, and losses are increased by the poor farming practice prevalent in this area, in which only one crop is grown a year and the land is under grass for the rest of the time, impure seed stocks, including a high percentage of pigmented grains, are used, and the seed is sown broadcast over areas too large for good cultural methods to be applied, resulting in uneven ripening. In the low yields obtained, the proportion of grains discoloured by only a light infestation is disproportionately high.

In the eighth part, an account is given of limited field experiments on control by means of insecticides, which were greatly hampered by the prevailing scarcity of sufficiently dense infestations. The results indicated that, in the absence of facilities for aircraft treatment, application as dusts or fogs that drift with the wind is the most practicable under local conditions. Some ten insecticides were tested, and though the results with many were inconclusive, dusts of 20 per cent. BHC (2·6 per cent. γ isomer) or of 0·2 per cent. pyrethrins with 2 per cent. piperonyl butoxide applied by portable apparatus were effective. Rates of 20–30 lb. per acre are regarded as ample, and 15 lb. would probably suffice. Dusts containing up to 2·5 per cent. γ BHC as lindane were disappointing, and one of derris and nicotine that was effective is considered unsuitable owing to the hazard to the operators; a derris-extract dust was effective in one of several tests in which it was included. BHC appeared not to damage the plants or reduce their yield, but no treatment is likely to give protection for more than a few days, owing to the mobility of the pest. In the ninth section, in which the status of the Pentatomid is assessed and recommendations for reducing losses are made, it is emphasised that severe losses occur only sporadically and in any one locality only once in 10–15 years. During heavy infestation, dusting with BHC is of value even on poor crops, and dusts of activated pyrethrins should give economic control on crops of high potential yield if the risk of toxic residues left by BHC is considered too great. Grain discoloration occurs in many districts in the absence of outbreaks, but the economic practicability of preventive measures cannot be assessed until more detailed analyses indicating its effect on grade are available. If control measures against *S. poecila* are justifiable for the prevention of discoloration, it would be necessary to apply them against even light infestations, and growers who dispose of their crop as unhusked rice, for which there is no grading system, would be unlikely to co-operate. Improved agricultural practice is considered essential where damage by *S. poecila* is important.

The report includes several appendices, of which one (pp. 111–115) contains an annotated list of outbreaks between 1904 and 1952, another (p. 117) contains notes on several other Pentatomids observed on rice, of which the only one of any importance was *S. ypsilon-griseus* (Deg.), and a third (p. 118) contains the results of a population survey based on collections made by sweeping with hand-nets in 92 fields in the autumn of 1952. The numbers of *S. poecila* obtained per 300 sweeps exceeded six in less than half the 415 samplings made. A report by E. G. Giglioli on investigations of the damage due to *S. poecila* in British Guiana made in 1951 is quoted in a fourth appendix (p. 116). A target-like lesion shown in a field test to characterise damaged grains was found on only a small proportion of rice of the spring crop, which was believed locally to be damaged by this Pentatomid. Autumn crops were reported to be severely damaged, but though

many of the grains were blackened, few bore the characteristic lesion and a survey over 4,000 acres established that the Pentatomid was almost entirely absent from the fields.

Adkisson (P. L.). **Influence of Irrigation and Fertilizer on Populations of three Species of Mirids attacking Cotton.**—*FAO Plant Prot. Bull.* **6** no. 3 pp. 33–36, 2 refs. Rome, 1957.

Psallus seriatus (Reut.), *Adelphocoris rapidus* (Say) and *Lygus lineolaris* (P. de B.) infest cotton in Missouri. As earlier work indicated that Mirid populations may be influenced by irrigation or rainfall and that the bugs are attracted by the presence of succulent plants [*cf. R.A.E.*, A **21** 655], the effects of irrigation and fertilisers were investigated in a split-plot test in 1956. All three Mirids were present, with *P. seriatus* predominating, but they were not differentiated in the counts, which were made weekly from 7th July. The results showed no significant differences in population until drought symptoms appeared in the non-irrigated plots, but numbers were greatest thereafter on irrigated plots receiving most fertiliser and least on non-irrigated plots receiving small amounts of fertiliser. In nearly all cases, there were more insects in the irrigated fertilised plots than in the non-irrigated counterparts. The differences were due to both fertiliser and irrigation. Although no insecticides were applied, the yields from the fertilised irrigated plots were good.

Berg (G. H.). **Campaign against the Mediterranean Fruit Fly in Costa Rica.**—*FAO Plant Prot. Bull.* **6** no. 4 pp. 53–56. Rome, 1958.

The initiation of the campaign for the eradication of *Ceratitis capitata* (Wied.) from Costa Rica [*cf. R.A.E.*, A **45** 445] necessitated a survey to determine the exact distribution of this fruit-fly, and this was begun at the end of October 1957. Bait-traps were placed in 124 localities where little or no surveying had previously been done, where light infestations had been noticed, or where infestation was suspected, and the results indicated that although some spread had occurred since the previous survey [*loc. cit.*], the situation was not critical. About a quarter of the country is infested, and a list is given of the localities in six provinces in which the fruit-fly is known to occur. Trapping in the rainy season in previously known infested areas indicated very low adult populations, and heavy rains apparently have an inhibitory effect on the population. Numbers increase rapidly, however, in January, at the beginning of the dry season, and the peak is reached in April, after which there is a stationary period and then a decline as the rains increase. The range of host-fruits infested has increased. Mangos are now attacked as severely as oranges on the central plateau, followed by star-apples (*Chrysophyllum cainito*), *Spondias* spp. and coffee berries, but coffee is still preferred in the Turrialba region [*cf. loc. cit.*].

McGregor (E. A.). **The Mites of *Citrus* Trees in Southern California.**—*Mem. S. Calif. Acad. Sci.* **3** no. 3, 42 pp., 11 pls., 3 figs., 55 refs. Los Angeles, Cal., 1956.

The mites dealt with are all those known to occur on *Citrus* trees in southern California, and they include predacious as well as phytophagous forms. A few species are described as new. Collection records and very

brief notes on habits are given for most of the species, and many of them are figured.

Somsen (H. W.) & Luginbill jr. (P.). *Bracon lissogaster* **Mues. A Parasite of the Wheat Stem Sawfly.**—*Tech. Bull. U.S. Dep. Agric.* no. 1153, [1+] 7 pp., 1 fig., 4 refs. Washington, D. C., 1956.

Bracon lissogaster Mues. [*cf. R.A.E.*, A **45** 201] is an ectoparasite of the larvae of *Cephus cinctus* Nort. that was found in Montana in 1949 for the first time and was subsequently reported from eight counties in the north-centre of that State. It mostly attacks larvae infesting wild and cultivated grasses and has only occasionally been reared from those on wheat. It has two generations a year, the adults appearing in late June and mid-August, overwinters in the larval stage in cocoons in the stems and develops singly or gregariously. All stages and the cycle of development are described.

Douglass (J. R.) & Hallock (H. C.). **Relative Importance of various Host Plants of the Beet Leafhopper in southern Idaho.**—*Tech. Bull. U.S. Dep. Agric.* no. 1155, [1+] 11 pp., 5 figs., 4 refs. Washington, D. C., 1957.

The following is based on the authors' summary. The importance of 43 species of plants in 13 families, mostly Chenopodiaceae or crucifers, as spring and summer food-plants of *Circulifer tenellus* (Baker) in southern Idaho was studied in 1940–54, in the spring-breeding areas of the Cicadellid, in the greenhouse, and in field tests. In burned, overgrazed, or deteriorated rangeland, the most important were flixweed (*Descurainia sophia*), perfoliate pepperweed (*Lepidium perfoliatum*) and tumblemustard (*Norta* (*Sisymbrium*) *altissima*). In the areas where sagebrush (*Artemisia tridentata*) predominates, green tansymustard (*D. pinnata* var. *filipes*) was the most important. Dwarf phlox (*Phlox gracilis*) and mousetail (*Myosurus aristatus*) were recorded at 30 to 40 per cent. of the points investigated and were often the predominant food-plants, but as they generally matured and dried early they were less important. The greenhouse studies showed that curled dock (*Rumex crispus*), blistercress (*Erysimum repandum*), green tansymustard, and perfoliate pepperweed were the most attractive species for egg-laying. Flixweed and small pepperweed were moderately attractive. In the plot studies, nymphs were generally recorded for a shorter period on plants occurring in early summer than on plants growing in mid- or late summer. The largest nymphal populations were produced on fanweed (*Thlaspi arvense*) in early summer, patata (*Monolepis nuttalliana*) in midsummer, and smotherweed (*Bassia hyssopifolia*) in late summer. There was no significant difference between the nymphal populations developing on cut-leaved nightshade (*Solanum triflorum*), redscale (*Atriplex rosea*), Russian thistle (*Salsola kali* var. *tenuifolia*) and smotherweed during late summer.

Douglas (W. A.) & Eckhardt (R. C.). **Dent Corn Inbreds and Hybrids resistant to the Corn Earworm in the South.**—*Tech. Bull. U.S. Dep. Agric.* no. 1160, [1+] 13 pp., 5 figs., 5 refs. Washington, D.C., 1957.

The following is based on the authors' summary. In the southern United States, losses due to the feeding of *Heliothis zea* (Boddie) on the ears of maize amount to millions of bushels annually. A co-operative programme was undertaken by the U.S. Department of Agriculture and the Mississippi

Agricultural Experiment Station from 1942 to 1951 to decrease these losses through the breeding of dent maize hybrids resistant to injury. Data were obtained on damage in inbreds, through rating of their performance in single crosses, and in single- and double-cross hybrids. Five highly resistant white inbreds and a highly resistant yellow inbred were found to transfer their resistance to their single-cross progenies. Twelve white inbreds and five yellow inbreds were classified as resistant. In addition, the susceptibility of many other inbreds to damage was determined through studies of their performance in single crosses. Three commercial hybrids showing resistance to *H. zea* are now widely grown. One of them showed negligible losses due to infestation, and another only about one-sixth of the damage caused to an open-pollinated variety. Extreme length of husk proved not necessary or even desirable [*cf. R.A.E.*, A **37** 243].

Howitt (A. J.) & Painter (R. H.). **Field and Greenhouse Studies regarding the Sources and Nature of Resistance of Sorghums,** *Sorghum vulgare* **Pers., to the Corn Leaf Aphid,** *Rhopalosiphum maidis* **(Fitch).**—*Tech. Bull. Kans. agric. Exp. Sta.* no. 82, 38 pp., 5 figs., 3 refs. Manhattan, Kans., 1956.

Since no effective methods of controlling *Aphis* (*Rhopalosiphum*) *maidis* Fitch on sorghum are known, the breeding of resistant strains of the food-plant is desirable, and investigations on the sources and nature of resistance were therefore carried out in Kansas and are here recorded in detail. The following is based on the authors' summary of the work. A wide range in infestation by the Aphid was found among 595 varieties of sorghum in field and greenhouse observations involving nearly 14,000 plants; 460 varieties that included the world germ plasm of sorghums available in the United States were tested in the greenhouse, and comparative rates of reproduction were studied on 16 varieties. The components of resistance mostly investigated were the combined mechanisms of preference and antibiosis [*cf. R.A.E.*, A **45** 352], as evaluated by measurements of percentage infestation, number of progeny per infested plant, number of winged Aphids per plant per day, an index number derived from these values, and the total number of progeny produced by a given number of Aphids confined on a plant. It was found that Sudan sorghums, notably Piper Sudan, consistently and without exception showed a high level of resistance, carrying the factors for both non-preference and antibiosis. Combine and milo sorghums proved highly susceptible. Differences in resistance between plants of the same strain were found in some varieties.

Gojmerac (W. L.). **Effect of Formulations and Rates of Insecticides on Sugar Beets.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **19** no. 3 pp. 97–100, 2 figs. Fargo, N. Dak., 1957.

Further tests were made in North Dakota in 1956 on the effect of organic insecticides, applied for the control of the sugar-beet root maggot [*Tetanops myopaeformis* (Röder)], on plant germination and yield [*cf. R.A.E.*, A **45** 223, 440]. When fertiliser was sprayed with the insecticides and applied to give 1 lb. actual toxicant per acre, heptachlor appeared to be less phytotoxic than aldrin, dieldrin or Hercules AC 528 [2,3-p-dioxandithiol S,S-bis(O,O-diethyl phosphorodithioate)]; the numbers of beets harvested from the plots showed that thinning had eliminated most of the plant reduction caused by the insecticides. When granular insecticides were mechanically distributed

in the row with the beet seed at rates of 0·8–5·4 lb. aldrin, 0·5–6·2 lb. dieldrin and 0·32–6·5 lb. heptachlor per acre, all doses of aldrin and dieldrin reduced germination considerably and all but the lowest dose of heptachlor reduced it slightly; 2·1 lb. aldrin and 1·9 lb. dieldrin or more reduced the yield, whereas lower rates and all rates of heptachlor increased it. On another farm, aldrin granules gave more favourable results, and heptachlor at higher rates (6·5–16 lb. per acre), on Attaclay or vermiculite, reduced stands and, to some extent, yields. In both tests, dieldrin at 6·2 lb. practically eliminated the crop. All the insecticides and both methods of application gave satisfactory control of *T. myopaeformis* and yield increases were considerable where the stands were not severely reduced. Treatment of the seed with 1 lb. dieldrin per 100 lb. reduced germination considerably, but increased the yield.

Stern (V. M.) & Reynolds (H. T.). **Aphid Resistance to Parathion.**—*Calif. Agric.* **11** no. 2 pp. 4, 14. Berkeley, Cal., 1957.

Increasing numbers of reports were received in the summer of 1956 of the failure of parathion and malathion to control *Myzocallis* (*Therioaphis*) *maculata* (Buckt.), against which they were formerly effective [*cf. R.A.E.*, A **45** 15], on lucerne in California. Resistance to parathion appeared to be restricted to localities in the Mojave River basin and in the Imperial and Coachella Valleys, but increasing difficulty in achieving control was also reported from parts of the Antelope Valley. Tests with resistant and susceptible Aphids showed that treatment with 2·3 oz. parathion in 9·5 U.S. gals. spray per acre caused 76·8 and 85·5 per cent. reduction in numbers of the former after 24 and 48 hours, respectively, as compared with untreated plots, the survivors being mainly adults, whereas treatment with 2·4 oz. parathion in 12 U.S. gals. spray gave more than 99 per cent. reduction of the latter after 1–3 days. In laboratory tests, the resistant Aphids were about four times as tolerant of parathion as the non-resistant ones.

Among additional insecticides tested, Phosdrin [dimethyl 2-methoxycarbonyl-1-methylvinyl phosphate] gave excellent immediate control of both forms at about 0·5 oz. or more in 10·5–12 U.S. gals. spray per acre, but not at lower rates; it showed little residual action and did not control Aphids migrating into the field. Trithion [O,O-diethyl S-p-chlorophenylthiomethyl phosphorodithioate] showed greater residual toxicity, giving 83·7 and 91·4 per cent. reduction of resistant Aphids after one and two days when used at 3·8 oz. in 15 U.S. gals. spray and 69·1 and 95·1 per cent. of the non-resistant ones after one and three days when used at 2·9 oz. in 9·9 U.S. gals.

Hall (I. M.) & Dunn (P. H.). **Fungi on Spotted Alfalfa Aphid.**—*Calif. Agric.* **11** no. 2 pp. 5, 14, 1 fig. Berkeley, Cal., 1957.

Five unidentified species of entomogenous fungi attack *Myzocallis* (*Therioaphis*) *maculata* (Buckt.) on lucerne in California; two show high pathogenicity for the Aphid and, under favourable natural or artificial moisture conditions, cause marked reductions in population when evenly distributed. One appears to have spread rapidly over much of southern California and has controlled Aphid populations in widely scattered fields. The occurrence of the fungi in the State is far from uniform, and a programme was begun in 1956 in which almost 1,800 cultures were distributed in infested fields in 12 counties during the summer. Numerous instances

are cited of the excellent control obtained, and it is concluded that the fungi should become an important factor in the control of *M. maculata* and a useful adjunct to predacious Coccinellids [*cf. R.A.E.*, A **45** 12].

Clark (E. C.). **Observations on the Ecology of a Polyhedrosis of the Great Basin Tent Caterpillar** *Malacosoma fragilis*.—*Ecology* **36** no. 3 pp. 373–376, 10 refs. Brooklyn, N.Y., 1955. **Survival and Transmission of a Virus causing Polyhedrosis in** *Malacosoma fragile*.—*Op. cit.* **37** no. 4 pp. 728–732, 9 refs. 1956.

A polyhedral virus disease caused high mortality among the larvae of *Malacosoma fragile* (Stretch) on *Ceanothus cordulatus* in Fresno County, California, in 1952 [*cf. R.A.E.*, A **43** 42], and the way in which the virus persists from year to year was investigated. In the work described in the first of these papers, three egg-masses deposited in 1952 in the area of the epizootic were collected in April 1953 and taken to the laboratory. The larvae that hatched from two of them all developed the disease and died, but mortality was not complete in the third batch. Examination at the same time of plants on which larvae had died in 1952 showed that some of the cadavers were still attached to the plants. A suspension prepared from several taken to the laboratory proved infective for all of 15 healthy larvae that fed on foliage sprayed with it. The disease occurred again in the same area in 1953 and reduced the population to negligible proportions. When larvae infected as a result of feeding on sprayed foliage were placed among a healthy population on *Purshia tridentata* in the field, the disease appeared among the latter and caused high mortality, presumably as a result of infection from disintegrated dead individuals.

The field tests described in the second paper confirmed that virus that persists on inedible parts of the food-plant through the winter is a true source of infection for larvae of the succeeding generation.

Rudinsky (J. A.) & Vité (J. P.). **Effects of Temperature upon the Activity and the Behavior of the Douglas Fir Beetle.**—*For. Sci.* **2** no. 4 pp. 258–267, 5 figs., 8 refs. Washington, D.C., 1956.

Dendroctonus pseudotsugae Hopk. is an important pest of Douglas fir [*Pseudotsuga menziesii*] in the Pacific Northwest of the United States, but much basic information on it is lacking. The effects of temperature on the activity and behaviour of the adults of this Scolytid were investigated in the laboratory in Oregon in 1955–56, and the following is virtually the authors' summary of the results. *D. pseudotsugae* shows well-organised activity between 10 and 34°C. [50 and 93·2°F.]. The beetle still has sufficient capability for boring in and for locomotion at the lower limit. This limit is also characterised by loss of ability to fly and by the change from positive to negative phototropism—the latter change marking the behaviour of the beetle outside the bark. At the upper limit, the shock reactions of restlessness and predominantly negative phototropic behaviour lead the beetles to avoid higher temperatures than 33°C. [91·4°F.], which sooner or later would cause thermal paralysis and finally thermal death. The same limit restricts the regulated locomotion and the ability to bore in, whereas the flight performance remains the same. Within this clearly defined zone of activity, there are two distinct temperature spans: the first, between 18 and 22°C. [64·4 and 71·6°F.], gives the conditions to start flying; the second, between 26 and 32°C. [78·8 and 89·6°F.], encloses the optimum

for regulated locomotion. It appears that the thermopreferendum of the beetle lies between these two spans of temperature.

Connola (D. P.), Collins (D. L.), Risley (J. H.) & Smith (W. E.). **Insect Damage and its Prevention in Windthrown Saw Timber.**—*Bull. N.Y. St. Mus. Sci. Serv.* no. 352, 36 pp., 23 figs., 9 refs. Albany, N.Y., 1956.

Trees, largely red spruce [*Picea rubens*], were blown down over a considerable area in forests in the Adirondack Mountains of New York in November 1950, and investigations were subsequently made on the insects that infested the fallen timber and their control [*cf. R.A.E.*, A **41** 354]. Insect attack began in 1951 and increased in 1952. Softwoods, including *P. rubens*, were mainly infested by *Trypodendron bivittatum* (Kby.), *Gnathotrichus materiarius* (Fitch), *Tetropium cinnamopterum* (Kby.), *Monochamus scutellatus* (Say) and *M. notatus* (Dru.), and hardwoods by *Xyloterinus politus* (Say) and *Pterocyclon* (*Monarthrum*) *mali* (Fitch). Mill studies in 1953 on cut lumber from salvaged logs of *P. rubens* showed a direct correlation between the numbers of entries visible on the surface and the amount of damage in the cut timber, but the relation differed with other species, so that damage to them could not be predicted from the results for *P. rubens*. Furthermore, the proportion of a cut log to show insect damage varied with other factors. Of various insecticides tested for the protection of newly sawn logs, 12 per cent. DDT in kerosene applied thoroughly by hand equipment gave the best results and afforded protection for more than a year. In a yard in which birch logs were stacked, sprinkling with water to prevent dry rot reduced attack by *Xylotrechus colonus* (F.).

Reeks (W. A.) & Smith (C. C.). **The Satin Moth, *Stilpnotia salicis* (L.), in the Maritime Provinces and Observations on its Control by Parasites and Spraying.**—*Canad. Ent.* **88** no. 10 pp. 565–579, 2 maps, 18 refs. Ottawa, 1956.

Stilpnotia salicis (L.) was first observed in the Maritime Provinces of Canada in 1930, when it occurred in New Brunswick and Nova Scotia [*cf. R.A.E.*, A **19** 756], apparently as a result of dispersion from the north-eastern United States. It reached Newfoundland in 1934, Cape Breton and Prince Edward Islands in 1935, the Magdalen Islands in 1937, and Quebec in 1938 [*cf.* **29** 626]. By 1954, it was present in much of the more populated areas in these Provinces, being closely associated with the planting of poplars as shade trees; willow, its other food-plant, is scarce, but is occasionally attacked. Carolina poplar (*Populus eugenei*) and silver poplar (*P. alba*) are preferred, and balsam poplar (*P. balsamifera*) and Lombardy poplar (*P. nigra* var. *italica*) less frequently infested. Defoliation for four consecutive years causes considerable mortality of branches, and four of 46 Carolina poplars in New Brunswick that were defoliated almost completely in 1946 and 1947 and lightly or moderately in 1948–54 were dead by 1955; branch mortality on the others averaged 40 per cent. In addition, larvae migrating from trees near houses constitute a nuisance.

The bionomics of *S. salicis* vary with climate. In New Brunswick, eggs are laid in masses of 200 or more on the trunks and on sites such as posts and buildings; on a defoliated 40-ft. poplar, most were situated on the trunk below the crown and the rest in the lower crown. Eggs were present from about 15th July until 15th August, and three females caged with foliage of Carolina poplar laid 588–1,061. The larvae hatched after about 14 days, with a peak in the first week of August, fed on the leaves and overwintered

in crevices, in webs containing particles of bark, hibernation being general by 10th September. Feeding was resumed for a short period from 3rd–20th May and pupation occurred in silken cocoons on foliage, buildings and other sites from about 1st July. The adults emerged between 10th July and 10th August, with a peak during the last ten days of July. Development is somewhat later in Newfoundland.

Many overwintering larvae die when air temperatures fall below −30°F., and cold is the principal climatic factor of control. Native parasites and disease organisms have little effect. Parasitism by *Apanteles solitarius* (Ratz.), which was introduced into New Brunswick and Newfoundland in 1933 and now occurs in all the main infested areas in the Maritime Provinces, varies considerably with season and locality [*cf.* **34** 129]. This Braconid has two generations a year and overwinters as a first-instar larva in the host or as a prepupa in the cocoon. The adults of the overwintered generation emerge in late May or June and those of the first generation about a month later, and they oviposit in overwintered and in first- or second-instar host larvae, respectively. *A. solitarius* is itself attacked by several parasites, of which the most important is *Dibrachys cavus* (Wlk.). *Compsilura concinnata* Mg. was released against *S. salicis* in Nova Scotia and New Brunswick during 1932–37 [*cf.* also **24** 246] and has been recovered in the Maritime Provinces from *S. salicis* and 13 other Lepidoptera. Many of these overwinter as pupae [*cf.* **14** 257], and the failure of *C. concinnata* to overwinter successfully in *S. salicis* is probably due to the fact that the latter hibernates in the larval stage. Superparasitism was common, and there appeared to be one complete generation in *S. salicis* and a second and partial third in alternative hosts. The effectiveness of *C. concinnata* depends largely on the abundance of suitable hosts in which to overwinter, and parasitism of *S. salicis* by it varied from 1·1 to over 90 per cent. *Meteorus versicolor* (Wesm.) and *Eupteromalus nidulans* (Först.) have also been released, but the former appears to be of little value and the latter is not definitely known to be established.

Chemical control of *S. salicis* is sometimes necessary on infested trees near houses. A spray of 5 lb. lead arsenate and 3 lb. pyrethrum powder (containing at least 0·8 per cent. pyrethrins) per 100 gals. applied, with or without an adhesive, to poplars 15–55 ft. in height on 13th June 1938 in a town in New Brunswick gave complete control of the larvae by the following day, and there was no noticeable reinfestation until 1945; this spray should normally be applied when the leaves are first fully developed. In laboratory tests, DDT in a suspension or emulsion spray gave complete control of the larvae in 3–5 days when applied at 1–2 lb. per 100 gals. to foliage on which they subsequently fed and in six days when applied at 10 lb. per 100 gals. to bark over which they crawled. Preliminary field tests indicated that foliage sprays containing 2 lb. DDT and 1 pint linseed oil per 100 gals. should give satisfactory control. In 1946, 1947 and 1955, DDT sprays were effective against newly hatched larvae migrating to the foliage when applied at 5 lb. DDT with 1 pint linseed oil to the rough bark and lower branches of poplar trees in early August. Slight feeding occurred in autumn, but none in the following spring.

Monteith (L. G.). **Influence of Host Movement on Selection of Hosts by *Drino bohemica* Mesn. (Diptera: Tachinidae) as determined in an Olfactometer.**—*Canad. Ent.* **88** no. 10 pp. 583–586, 1 fig., 19 refs. Ottawa, 1956.

Earlier studies on host selection in *Sturmia* (*Drino*) *bohemica* (Mesnil) [*R.A.E.*, A **45** 404] indicated that the more active host larvae were the

most attractive, and investigations were therefore carried out to determine the nature of the stimulus involved. The following is almost entirely the author's summary of the work. The movement of feathers trimmed to resemble host larvae was a strong visual stimulus for *S. bohemica*, provided that the parasite had already been stimulated by the odour of a host (*Neodiprion lecontei* (Fitch)). Larval movement was simulated by suspending the feathers in the air stream in one arm of a Y-shaped olfactometer in which the same host odour was passed through both arms. The response by the parasite to the moving feathers was very pronounced, but the influence of host movement would be modified by other factors in the field, such as olfactory and chemotactic stimuli from the host and from its food-plant, which were shown in the earlier work to affect selection.

Carroll (W. J.). **History of the Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.), (Lepidoptera: Geometridae) in Newfoundland, and Notes on its Biology.**—*Canad. Ent.* **88** no. 10 pp. 587–599, 2 graphs, 1 map, 8 refs. Ottawa, 1956.

Four periods of heavy infestation by *Lambdina fiscellaria fiscellaria* (Gn.) have occurred in forests in Newfoundland since 1912, and mortality of balsam fir (*Abies balsamea*) has in most cases been severe. Observations on the bionomics of the Geometrid on *A. balsamea* in 1950–51 showed that winter is passed in the egg stage. The larvae hatched between 6th and 30th June, and passed through four instars; the larval stage lasted 43–55 days in the laboratory, and no larvae were seen in the field after 18th August. In feeding experiments, young larvae completed their development on new foliage of *A. balsamea* or white spruce (*Picea glauca*) and on leaves of birch (*Betula papyrifera*) or maple (*Acer rubrum* and *A. spicatum*), but not on old foliage of spruce or balsam, moss or leaves of other deciduous plants. In the third and fourth instars, old foliage of spruce or balsam was acceptable. Preliminary tests showed a photopositive reaction that enables larvae to reach new foliage at the branch tips and a photonegative reaction in the post-feeding stage that cause them to seek darkened pupation sites. Pupation takes place in dry, decayed stumps or in crevices in the bark, on lichens on the trunks and, occasionally, on the forest floor. Pupae were first found on 2nd August, and the pupal stage lasted 20–23 days. Adults were present in the field from 23rd August until 30th October. The life-span of adult males and females in screen cages in the open averaged 9·4 and 14·3 days, respectively; the ratio of males to females was 45 : 55. Eggs were laid, usually singly, on moss and lichen on the trunks or stumps or under old bark scales.

In 1950, a wilt disease caused mortality, probably exceeding 70 per cent., among older larvae and pupae and was of importance in ending several outbreaks, but subsequently caused no noticeable mortality. It is probably indigenous, since it is unlikely that a virus obtained from the insect in Ontario and introduced in 1948 could so soon have become widespread. Some dozen parasites, a list of which is given, were reared from the larvae, pupae or eggs, an undescribed species of *Apanteles* near *A. flavovariatus* Mues. from the larvae and *Aoplus velox* (Cress.) from the pupae being the commonest; each caused about 30 per cent. mortality. Several colonies of *Winthemia occidentis* Reinh. were introduced from British Columbia and liberated in 1949–51, and a few larvae tentatively determined as this Tachinid emerged from pupal cases of *L. f. fiscellaria* in 1951, but failed to overwinter; no other recoveries were made. All severe outbreaks originated in mature or overmature stands containing over 70 per cent.

balsam fir, and an increase in the spruce content of a stand seemed to result in a corresponding decrease in susceptibility [*cf. R.A.E.*, A **22** 631].

Lyons (L. A.). **Insects affecting Seed Production in Red Pine. Part I. *Conophthorus resinosae* Hopk. (Coleoptera: Scolytidae).**—*Canad. Ent.* **88** no. 10 pp. 599–608, 6 figs., 24 refs. Ottawa, 1956.

Damage to the cones of red pine (*Pinus resinosa*) by insects in Ontario is often severe enough to prevent or render uneconomic the collection of seed on a commercial scale, and in view of the increasing use of selected seed in reafforestation, the insects responsible for the damage were investigated in central and southern Ontario in 1950–54. In this paper, which is the first of a proposed series, information is given on the bionomics, injuriousness and natural control of *Conophthorus resinosae* Hopk., all stages and the distribution of which are briefly described.

Although second-year cones are preferred, *C. resinosae* frequently develops in shoots of the current year and occasionally in second-year cones of jack pine (*P. banksiana*). The overwintered adults feed on the cones and current shoots in May, and the females usually oviposit in late May, though attack may begin as early as mid-May or as late as mid-June. The female enters the underside of the cone close to the stem by a tunnel or groove excavated in it and bores along the axis, constructing niches, in each of which an egg is laid, in the cone substance; the number of eggs per cone varied from one to 11. Males are sometimes present, but unaccompanied females laid viable eggs; mating takes place within the cone. In an experiment, one of four females laid 17 eggs in four cones, and the others each attacked three cones, in which they laid 12, 15 and 22 eggs; the cones were attacked at intervals of 2–16 days. Infested cones soon wither, turn hard and brown, and occasionally fall; they disintegrate in the following year. The larvae feed indiscriminately on the seeds and scales and pupate in frass-lined cells, often near the base of the cone. In 1951, ovipositing females were present at least till mid-July, and adults of the next generation appeared a few days later. The egg stage, two larval instars and pupal stage lasted 17, 13, 22 and 19 days, respectively. Most adults leave the cones through the entry tunnel, and some emerge through the top or sides; in 1951, they remained in the cones for 12–13 days. Emergence from the cones was retarded when cone temperatures fell below about 22°C. [71·6°F.] and it increased as they rose to 43°C. [109·4°F.], which was the highest recorded. Adults tended to move towards light at low temperatures and away from it at high ones, with the 50 per cent. reversal point at about 27·5°C. [81·5°F.]. Soon after leaving the cone, the adults prepare to overwinter by entering short current-year shoots, or sometimes twigs of white pine (*Pinus strobus*), and tunnelling distally into the vegetative bud; the twigs soon break at the point of entry.

Larvae, pupae and immature adults in cones were destroyed by the larvae of a Malachiid tentatively identified as *Attalus nigrellus* (Lec.), larvae and pupae by Lepidopterous larvae, notably those of *Holcocera immaculella* McD., that feed in deteriorating cones, and larvae by *Leptodiplosis* sp. In 1952, about 60 per cent. of the infested cones in one place also contained larvae of *Eucosma monitorana* Heinr., and in these, mortality of *C. resinosae* was increased from about 18 to 97 per cent., as a result of competition. Unknown factors caused up to 12 per cent. mortality among immature stages, especially in small cones. Dead adults commonly found in the cones were probably killed by high temperatures, since mortality in

cones in direct sunlight was found to reach 20 per cent., as compared with none in shaded ones. Two adults of *Bracon rhyacioniae* (Mues.) were reared from larvae in shoots.

Perron (J. P.), LeRoux (E. J.) & Lafrance (J.). **Notes on** *Coenosia tigrina* **(F.) (Diptera: Anthomyiidae), mainly on Habits and Rearing.** —*Canad. Ent.* **88** no. 10 pp. 608–611, 2 figs., 1 ref. Ottawa, 1956.

The Anthomyiid, *Coenosia tigrina* (F.), the adults of which are well-known predators of small Diptera in Europe [*cf. R.A.E.*, A **20** 711; **22** 83; **36** 174], was observed, for the first time in Canada, at Ottawa in 1943 and was found destroying adults of the onion maggot (*Hylemyia antiqua* (Mg.)) in rearing cages in Quebec in 1951 [**41** 112]. Subsequent surveys showed it to be abundant and of importance in the control of root maggots in south-western Quebec, and it was also reported in Prince Edward Island and southern Ontario. In Quebec, the adults are usually present from early May till late October, their period of activity coinciding with that of *H. antiqua*. They feed on various small flies in hotbeds in early spring and are common in summer and early autumn on weeds or cultivated plants where other Diptera are present; they also attack small Hemiptera. The method of feeding is described. In the insectary, recently emerged adults killed an average of five adults of *H. antiqua* per day, and older ones one or two. The preoviposition period lasted 8–18 days, with an average of 15. Field-collected females laid an average of 20–25 eggs per day. The eggs are deposited, usually singly, on or just beneath the surface of the soil and are present from late May until late October; 85 per cent. of those laid in the laboratory hatched, the egg stage lasting 3–8 days. Larvae completed their development when they were kept singly between two sheets of filter paper soaked in water and one newly formed, freshly opened puparium of *H. antiqua* was provided daily for the first five days and two subsequently, but survived for only 7–8 days when punctured larvae of *H. antiqua* were the only food. Attempts to rear them on roots or other vegetable matter, horse manure or milk were unsuccessful. At laboratory temperature, the larval, prepupal and pupal stages lasted about 12–14, 1–2 and 15 days, respectively. As the adults of *C. tigrina* and *H. antiqua* are frequently found together, characters distinguishing them are listed.

Begg (J. A.). **Control of Wireworms in early Potatoes with Heptachlor applied to the Soil after Planting.**—*86th Rep. ent. Soc. Ont. 1955* pp. 45–48, 6 refs. [Guelph, Ont., 1956.]

In Ontario, the application of organic insecticides to the soil before planting has been found to protect potatoes from attack by wireworms, but as the seed pieces are occasionally planted in infested untreated soil and require protection later, the effect of treatment with heptachlor at various times after planting was tested in 1955. Potatoes were planted on 12th–13th April in a field infested with *Limonius agonus* (Say), and heptachlor was applied 10, 20 or 34 days later at 2 lb. per acre in 2·5 per cent. granules placed at depths of 4–6 ins. on both sides of the row by means of a fertiliser side-dresser, or at 3·65 lb. per acre in an emulsion spray, the insecticide in the latter case being worked into the top 4–6 ins. of soil as near the rows as was considered safe. All treatments reduced the wireworm population, as recorded after harvest, and increased the proportion of high-class tubers, but only the row treatment made 10 or 20 days after planting

gave commercial control. The treatments applied on the first two dates, at a distance of 4 ins. from the row, did not seriously disturb the seed pieces, but those made after 34 days, at a distance of 6 ins., uprooted a few plants, which were replanted and suffered no decrease in yield.

HIKICHI (A.) & HALL (J. A.). **Experiments on Control of the Strawberry Leaf Roller,** *Ancylis comptana fragariae* **(W. & R.), in Norfolk County, Ontario.**—*86th Rep. ent. Soc. Ont. 1955* pp. 50–53, 1 ref. [Guelph, Ont., 1956.]

Severe infestation of strawberry by *Ancylis comptana* (Froel.) (*fragariae* (Walsh & Ril.)) has become general throughout Norfolk County, Ontario, in recent years, and insecticides were tested against the larvae in 1954 and 1955. Quantities of insecticides applied in sprays are given per 100 gals. per half acre.

In tests against first-generation larvae in 1954, wettable-powder sprays were applied on 9th June, when the first eggs were on the point of hatching, and also, in some plots, on 21st June. One or two applications of 2·5 lb. 50 per cent. DDD or 25 per cent. malathion resulted in significantly fewer living larvae on 9th July than one or two of 2·5 lb. 20 per cent. aldrin or one of 5 lb. lead arsenate, and tended to increase the production of runners. As the second application gave little or no added control, a single application on 1st June, at the peak of hatching, was made in 1955. All treatments significantly reduced the numbers of living larvae on 14th June, but 2 lb. 15 per cent. parathion, 25 per cent. diazinon [O,O-diethyl O,2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], 25 per cent. malathion or 50 per cent. DDD were significantly better than 2 lb. 50 per cent. methoxy-DDT (methoxychlor) or 6 lb. ryania.

A test against the second-generation larvae was made in 1954 in a field that had not been treated against the first generation. Insecticides were applied on 11th–17th August, and all reduced the numbers of living larvae found on 24th August. Sprays of 2 lb. 15 per cent. wettable parathion or 50 per cent. wettable DDD and a 7 per cent. DDD dust (applied at 25 lb. per acre) were the most effective and a spray of 0·5 pint 20 per cent. endrin emulsion concentrate the least so, and a malathion emulsion spray was superior to malathion or DDT wettable-powder sprays. An experiment with sprays containing 0·5–4 lb. 50 per cent. wettable DDD, applied on 3rd August, indicated that a concentration of 2 lb. should be effective. In a further test, wettable-powder sprays containing 2 lb. 15 per cent. parathion, 2 lb. 25 per cent. diazinon or 2 lb. of a mixture of 50 per cent. DDD and 25 per cent. malathion eliminated established larvae, some of which were in the late fifth instar, and sprays of DDD or malathion alone reduced the population from five per plant to insignificant numbers.

MAYBEE (G. E.). **Observations, Life-history, Habits, immature Stages, and Rearing of** *Loxotropa tritoma* **(Thoms.) (Hymenoptera: Proctotrupoidea) a Parasite of the Carrot Rust Fly,** *Psila rosae* **(F.) (Diptera: Psilidae).** —*86th Rep. ent. Soc. Ont. 1955* pp. 53–58, 3 figs., 12 refs. [Guelph, Ont., 1956.]

When *Loxotropa tritoma* (Thoms.), which normally has one generation a year and overwinters in the first instar in the puparia of its host, *Psila rosae* (F.), was introduced into Canada for release against that Psilid on carrot [*cf. R.A.E.*, A **43** 156], some of the females that emerged in the laboratory in spring oviposited in overwintered pupae that had completed

diapause and produced an intermediate partial generation that developed without diapause.

Attempts were therefore made to breed the parasite continuously in the laboratory, using a host that did not undergo diapause. *Drosophila melanogaster* Mg. proved suitable, and the technique of rearing and the life-history of the parasite in this host are described. *D. melanogaster* was reared on an agar gel containing dextrose, tomato juice and maize meal and sprinkled with brewers' yeast, and the larvae were allowed to pupate on moistened filter papers. These were subsequently exposed to the parasites on a rack in a glass jar for 24 hours, during which oviposition occurred, and adults of *L. tritoma* emerged from the parasitised puparia after 21–36 days. They were stored at 6·7°C. [44·06°F.] with moist dental cotton until needed and suffered no significant mortality in four weeks.

Females of *L. tritoma* deposited 15–46 eggs each at the rate of 1–8 per day, and the preoviposition, oviposition and incubation periods lasted 1–24 hours, 6–17 days and about three days, respectively. The three larval instars usually lasted 3·5–5 days each, though one first-instar larva was still active after 60 days, and the prepupal and pupal stages occupied one and 10–11 days. Adults lived for an average of about 18 days. Up to seven first-instar larvae were found in a single host pupa, but no parasites emerged from superparasitised hosts. The eggs and larvae of *L. tritoma* are briefly described; the pupa is formed in a cocoon in the puparium of the host.

Monro (H. A. U.), Buckland (C. T.) & King (J. E.). **Methyl Bromide Concentrations in Ship and Railway Car Fumigation of Peanuts.**— *86th Rep. ent. Soc. Ont. 1955* pp. 65–75, 3 figs., 8 refs. [Guelph, Ont., 1956.]

Stored products infested by insects when imported into Canada are now commonly fumigated with methyl bromide in the lake ships or railway cars in which they are moved from port, and the results are satisfactory provided that the carriers conform to the approved types. A large shipment of shelled groundnuts that arrived from India in May 1955 was found to be heavily infested by *Tribolium castaneum* (Hbst.), *T. confusum* Duv., *Tenebroides mauritanicus* (L.), *Oryzaephilus surinamensis* (L.) and *Plodia interpunctella* (Hb.), and fumigation was prescribed. The opportunity was taken to investigate the behaviour of the fumigant in a lake ship and a railway freight car, and also in groundnuts fumigated in the laboratory.

In the ship [*cf. R.A.E.*, A **37** 167], a dosage of 34 oz. methyl bromide per 1,000 cu. ft. was applied evenly through the load, and fans were operated for 30 minutes at the beginning of the fumigation period of 24 hours and at 2-hour intervals during it, and throughout the aeration period of 12 hours. The bags of groundnuts occupied about a quarter of the total space, and the temperatures were 58–82°F. in the free space and 70–72°F. in the commodity during fumigation. Complete control was obtained of all insects. Gas sampling at different points showed that the concentration reached equilibrium fairly rapidly; there was a continuous slight fall in concentration throughout the exposure similar to that observed in a laboratory chamber in which groundnuts received the same treatment, and this was due to continuous sorption of the fumigant by the groundnuts; the jute bags sorbed very little. At the end of fumigation, the percentage loss of the original nominal dosage was 77·8 in the ship, as compared with 67 in the laboratory.

In the freight car [*cf.* **35** 29], the dosage of 24 oz. methyl bromide per 1,000 cu. ft. was directed towards the ends of the car above the top of the load, which occupied 20 per cent. of the space, and the car was sealed for

20 hours. Temperatures were 47–96°F. in the free space and 67–69°F. in the commodity, and complete mortality was obtained of *Tribolium castaneum* and *T. confusum*, the only species present. Equilibrium concentration was reached fairly rapidly, and the percentage loss of the nominal dosage was 75·8, as compared with an estimated loss of 48·8 per cent. in the laboratory under similar conditions. There was some leakage and some sorption of the fumigant by the wooden floor and walls of the car, but sorption by the commodity was the principal cause of loss.

The minimum concentration-time products in the commodity (derived from concentrations in oz. per 1,000 cu. ft. and time in hours) were 285 in the ship and 153 in the freight car; the latter is shown to be adequate for control of all the insects found in the groundnuts except *Tenebroides mauritanicus*, but similar treatments have proved successful against this insect in the past.

West (A. S.) & DeLong (B.). **Notes on the Biology and Laboratory Rearing of a predatory Insect, *Zelus exsanguis* (Stahl) (Hemiptera: Reduviidae).**—*86th Rep. ent. Soc. Ont. 1955* pp. 97–101, 4 refs. [Guelph, Ont., 1956.]

In connection with work in Canada on the development of the precipitin test for studying the feeding habits of predacious insects [*cf. R.A.E.*, A **43** 439], field observations were made on the habits of *Zelus exsanguis* (Stål), which is relatively abundant near Kingston, Ontario, and a method was found for maintaining a colony of it during the winter. In the field, this predacious Reduviid appeared to be a general feeder and to have one generation a year. Adults were present from May until early July, and egg-masses, which are laid on the leaves of trees, from the first week of June, and the nymphs reached the fifth instar, in which they apparently overwintered, by early September. In the laboratory, three generations developed in the year when the bugs were reared on a variety of insects at field temperatures in summer and at 80–86°F. and 70–80 per cent. relative humidity in winter. The nymphs were cannibalistic, and those in the first instar died if confined singly, even when plentiful prey was provided, so that cannibalism may be obligatory. Brief descriptions of all stages and data on the duration of development of *Z. exsanguis* in the laboratory are included.

Holborn (J. M.). **The Susceptibility to Insecticides of Laboratory Cultures of an Insect Species.**—*J. Sci. Fd Agric.* **8** no. 3 pp. 182–188, 4 graphs, 3 refs. London, 1957.

The tests described were carried out to investigate natural differences in the susceptibility of insects to insecticides. Three strains of *Calandra granaria* (L.), two from laboratory cultures and one from a farm granary, and six strains of *Tribolium castaneum* (Hbst.) from various laboratories were reared to provide testing material of similar ages, and dusts containing 0·05–2 per cent. γ BHC, 0·1–4 per cent. pyrethrins, or 0·015–0·4 per cent. pyrethrins with ten times the amount of piperonyl butoxide as synergist were prepared, usually with a mineral carrier. These were mixed with wheat at the rate of 0·25 g. per 50 g., and the latter infested with 50 adult insects that had not fed for a day. Mortality counts were made after six days, and the results plotted on graphs, from which LD50 and LD80 values

were obtained. Rearing and testing were carried out at 25°C. [77°F.] and 60 per cent. relative humidity.

The three strains of *C. granaria* differed little in susceptibility to pyrethrins with piperonyl butoxide, but the LD50 of pyrethrins alone for the granary strain was 3·5 times as great and the LD80 6·5 times as great as those for one of the laboratory strains. Piperonyl butoxide was evidently a much more potent synergist for pyrethrins against the granary strain than against the other.

The strains of *T. castaneum* showed differences in susceptibility to each of the three insecticides. The least resistant of them was about four times as susceptible to γ BHC and about 3·5 times as susceptible to pyrethrins alone as the most resistant, but the difference between the two was much less for synergised pyrethrins. No considerable differences were found between the strains in weight, size or external characters, and though one of them was much more sluggish in behaviour than the others, it was about as susceptible to pyrethrins applied topically as to a dust deposit. It is concluded that the differences observed are due to differences in vigour, and they were found to persist unchanged in *Tribolium* through at least six generations. Although natural differences in susceptibility may not be as great as those resulting from acquired resistance, they should not be ignored in studying the effects of insecticides on insects.

HARDON (H. J.), BRUNINK (H.) & VAN DER POL (E. W.). **Colorimetric Determination of *p*-Chlorobenzyl *p*-Chlorophenyl Sulphide as a Spray Residue.**—*J. Sci. Fd Agric.* **8** no. 6 pp. 368–370, 2 graphs, 5 refs. London, 1957.

As the method for the colorimetric analysis of spray residues of chlorbenside (p-chlorobenzyl p-chlorophenyl sulphide) developed by Higgons & Kilbey did not give good results on apples, owing largely to interference by DDT residues [*cf. R.A.E.*, A **43** 404], it was modified by the use of chromium trioxide in glacial acetic acid for oxidation of chlorbenside to the sulphone before application of the m-dinitrobenzene colorimetric technique. Recovery of chlorbenside added to apple extracts was 90–98 per cent., and interference by DDT was avoided.

SIMMONDS (F. J.). **Seasonal Variation in Attack by *Diatraea* spp. on Sugar Cane in Trinidad.**—*Trop. Agriculture* (*Trin.*) **33** no. 3 pp. 221–231, 1 ref. London, 1956.

Of the three species of *Diatraea* that infest sugar-cane in Trinidad [*cf. R.A.E.*, A **30** 607], *D. saccharalis* (F.) has recently increased in importance, apparently owing to the planting of new cane varieties, such as B.37161. Collections of full-grown larvae between July and September–October 1948 showed that *D. saccharalis*, *D. impersonatella* (Wlk.) and *D. canella* Hmps. represented 4·6, 46·1 and 49·2 per cent., respectively, of the population in an area where an older variety predominated and 82·3, 9 and 8·7 per cent. where B.37161 was the chief variety. *Paratheresia claripalpis* (Wulp), the most important parasite, attacked 10·8 and 14·3 per cent. of the larvae of *D. saccharalis* in the two areas, respectively, but there was little difference in parasitism of the other two species by it or of all three by *Agathis stigmatera* (Cress.) or *Leskiopalpus diadema* (Wied.).

Further investigations were made in 1953 and 1954. In 1953, collections of larvae and pupae of *Diatraea* and puparia and cocoons of parasites were

made in two fields from May and in another from August, and, in 1954, similar sampling was carried out from the time canes were formed, in January and February, and supplemented by observations on plant infestation. The results are shown separately for several different varieties. Those obtained in 1954 indicated that the number of shoots produced was high in all varieties in comparison with the number of canes formed, so a moderate attack on the shoots would probably not affect the yield, although it is important in maintaining the *Diatraea* population. The number of canes found per acre varied little with variety, but their rates of development, and hence the periods during which they were susceptible to infestation, were different. Varieties producing shoots early were generally more heavily infested, and the total *Diatraea* population was high in January–February, declined in March, rose again in April–June and then again declined. B.37161 was very susceptible, supporting a consistently high population until October. Based on numbers of older larvae, *D. saccharalis* predominated at the beginning of the season and *D. canella* at the end of it; *D. impersonatella* was at no time important. The percentage parasitism by *P. claripalpis* was low early in the season and highest in August, when it reached 35·8 per cent. Parasitism of the puparia of *P. claripalpis* by *Trichopria cubensis* Fouts was very low.

The results for 1953 were less complete, but the total infestation by *Diatraea* was much heavier than in 1954, and the replacement of *D. saccharalis* by *D. canella* took place later. Parasitism by *P. claripalpis* was highest in June–July, when it reached 13·9–17 per cent., and parasitism of it by *T. cubensis* reached 66·7–75·7 in May–June, which may have accounted for the early decrease in parasitism by *P. claripalpis* in that year and the comparatively late decrease in the numbers of *D. saccharalis*, its principal host.

It is concluded that the recent increased importance of *D. saccharalis* is due to an actual increase in numbers of that species, and that the variation is affected significantly by the interaction of *P. claripalpis* and *T. cubensis*.

Simmonds (F. J.). **Additional Note on the Parasites of** *Diatraea saccharalis* **F. in the French Antilles.**—*Trop. Agriculture* (*Trin.*) **33** no. 3 p. 232, 1 ref. London, 1956.

During a visit to Guadeloupe in January 1956, the author found puparia of *Paratheresia claripalpis* (Wulp) associated with larval remains of *Diatraea saccharalis* (F.) on sugar-cane in several localities in the region in which this Tachinid had been released in 1954 [*cf. R.A.E.*, A **44** 355], so that it appears to be permanently established. *Lixophaga diatraeae* (Tns.) and *Metagonistylum minense* Tns., which also parasitise *D. saccharalis*, were observed on the neighbouring island of Marie Galante, and had apparently been introduced with sugar-cane planting material from Guadeloupe, since no deliberate release had been made. Growers stated that damage to sugar-cane by *D. saccharalis* was much less than it had been 20 years previously, although more susceptible varieties are now planted, and this was probably due to the action of these parasites. Other parasites of *Diatraea* seen were *Agathis stigmatera* (Cress.) and *Trichogramma minutum* Ril. Other pests of sugar-cane not previously recorded from the island comprised *Sipha flava* (Forbes), *Saccharosydne saccharivora* (Westw.), *Saccharicoccus sacchari* (Ckll.) and *Hortensia similis* (Wlk.). A predacious Coccinellid, *Cycloneda sanguinea* (L.), was associated with the first, and a Strepsipterous parasite, probably *Stenocranophilus quadratus* Pierce, and a predacious Reduviid, *Zelus longipes* (L.), with the second.

Sabrosky (C. W.). **A new Genus and two new Species of Chamaemyiidae (Diptera) feeding on *Orthezia* Scale Insects.**—*Bull. Brooklyn ent. Soc.* **52** (1957) no. 5 pp. 114–117. Lancaster, Pa., 1958.

Beingolea G. (O.). **Notes on a Chamaemyiid (Diptera) Predator of the Eggs of *Orthezia insignis* Douglas (Homoptera) in Peru.**—*T. c.* pp. 118–121, 6 figs., 2 refs.

In the first of these papers, the new genus *Melaleucopis* is erected for two new species described as *M. ortheziavora* (the type) and *M. simmondsi*, and a key is given differentiating it from *Leucopis*, with which it is closely related, and other genera of the group. The two new species were found feeding on *Orthezia*, the first in Peru and the second on *Euphorbia* and lime in the Grenadines (West Indies).

In the second paper, it is stated that *M. ortheziavora* attacks *O. insignis* Browne on olive and other plants in several coastal valleys of Peru, and all stages are briefly described. Preliminary observations showed that the eggs are laid externally on the egg sac of *O. insignis*, usually one on each, but sometimes two or three. The larvae feed on the eggs in the egg sac and pupate in it, the puparium being attached to the living *Orthezia* female. Sometimes the abdomen of the latter is attacked. Only one larva develops per sac, and at least 80 per cent. of the eggs in the latter are destroyed. Nevertheless, high infestations sometimes persist.

Russell (L. M.). **Synonyms of *Bemisia tabaci* (Gennadius) (Homoptera, Aleyrodidae).**—*Bull. Brooklyn ent. Soc.* **52** (1957) no. 5 pp. 122–123. Lancaster, Pa., 1958.

From comparison of type specimens or specimens from the food-plants and countries or general areas from which they are described, and original descriptions, the author gives a preliminary list of synonyms of *Bemisia tabaci* (Gennadius). In addition to *B. gossypiperda* Misra & Lamba and *B. hibisci* Tak. [*cf. R.A.E.*, A **28** 603, etc.], those mentioned in this *Review* include *B. inconspicua* (Quaint.) [*cf.* **38** 483; **43** 276], *B. bahiana* Bond. [**17** 321], *B. gossypiperda* var. *mosaicivectura* Ghesq. [**22** 620, etc.], *B. longispina* Priesn. & Hosny [**22** 710], *B. goldingi* Corb. [**24** 635; **26** 666], *B. nigeriensis* Corb. [**23** 605; **24** 635, 636–637] and *B. rhodesiaensis* Corb. [*cf.* **33** 126].

Burks (B. D.). **A new Parasite of the Rhodes-grass Scale (Hymenoptera, Encyrtidae).**—*Bull. Brooklyn ent. Soc.* **52** (1957) no. 5 pp. 124–127, 5 figs. Lancaster, Pa., 1958.

The Encyrtid described is *Dusmetia indica*, sp. n., adults of both sexes of which were reared from material of the Rhodes grass scale, *Antonina graminis* (Mask.), collected near New Delhi, India, in 1956. Additional examples were obtained in 1957 from material forwarded to the United States.

Patel (R. C.) & Kulkarny (H. L.). **Bionomics of the Pumpkin Caterpillar —*Margaronia indica* Saund. (Pyralidae: Lepidoptera).**—*J. Bombay nat. Hist. Soc.* **54** no. 1 pp. 118–127, 2 pls., 13 refs. Bombay, 1956.

Margaronia indica (Saund.) is an important pest of cucurbits in Bombay State. The larvae feed on the lower surfaces of the leaves, which they fold or bind together [*cf. R.A.E.*, A **35** 274], attack the ovaries of the flowers

and bore into the young developing fruits, which they render useless. Well-developed fruits with a hard rind escape attack. The authors describe all stages of this Pyralid, review its distribution and food-plants in India and elsewhere, and record investigations on its bionomics in 1952–54 at Anand, where *Trichosanthes dioica*, *Coccinia indica* and *Lagenaria vulgaris* were found to be infested. Eggs were laid singly or in groups on the lower surfaces of the leaves, and weekly observations showed that larvae were present from the first half of June to the second half of November; cocoons were spun among the leaves. Records of the daily food consumption and increase in body weight of larvae reared on *C. indica* in the laboratory showed that they fed little during the first five days but voraciously during the three days before the onset of pupation. The egg, larval and pupal stages lasted 4–6, 11–14 and 5–13 days at daily temperatures ranging from about 68 to 84°F. and 3, 9–12 and 5–6 days at a constant temperature of about 87°F. At a mean temperature of 81°F., males and females lived for 3–5 and 3–7 days, respectively, and the latter, which were more numerous than the males, laid 22–366 eggs each.

Venugopal (S.). *Tarache nitidula* **F., a Semilooper Pest on Cotton in South India.**—*J. Bombay nat. Hist. Soc.* **54** no. 1 pp. 207–210, 1 pl., 7 refs. Bombay, 1956.

Tarache nitidula (F.), which is widely distributed on the plains of southern India, causes serious injury to cotton in some years. The economic importance and food-plants of this Noctuid are briefly reviewed from the literature, all stages are briefly described, and an account is given of observations made during a severe infestation at Coimbatore in 1955. Pairing occurred one day after emergence. The females laid 30–40 eggs singly on the leaves, and the larvae hatched in 3–4 days, fed on the young leaves and pupated in the soil. The larval and pupal stages lasted 20–22 and 10–12 days, respectively, in July–August. In tests of sprays for control, 0·1 per cent. BHC, aldrin and dieldrin gave 100, 60 and 63 per cent. mortality of larvae, respectively, in 48 hours; DDT was less effective.

Maheswariah (B. M.) & Puttarudriah (M.). **Insect Pests of Cotton in Mysore.**—*Mysore agric. J.* **31** no. 4 pp. 220–226, 8 refs. Bangalore, 1956.

A list is given of 17 insects and a mite that infest cotton in Mysore, with notes on the type of damage caused, local distribution, natural enemies and control.

Maheswariah (B. M.) & Puttarudriah (M.). **Some Observations on the Life-history and Habits of** *Anoplocnemis phasiana* **Fabricius.**—*Mysore agric. J.* **31** no. 4 pp. 248–255, 4 pls., 11 refs. Bangalore, 1956.

As *Anoplocnemis phasiana* (F.) caused serious injury to egg-plant (*Solanum melongena*) and grape vines in Bangalore in May 1954 by feeding on the tender shoots, the authors review the synonymy, distribution and food-plants of this Coreid, describe all its stages and give an account of investigations on its bionomics in the laboratory, where the food-plant was *Erythrina* for the early stages and *S. melongena* for the later ones. The eggs were laid singly or in rows on the stalks or leaves, and hatched in 8–9 days, and the nymphal stage lasted 45–54 days. Both nymphs and adults suck the sap, causing shoots to wither and leaves to dry up. BHC

appeared effective for control, but collection of the bugs in the early morning, when they are inactive, is probably sufficient.

Oldroyd (H.). **Collecting, Preserving and Studying Insects.**—$9\frac{1}{4} \times 5\frac{3}{4}$ ins., 327 pp., 12 pls., 135 figs., 1 map, 5 pp. refs. London, Hutchinson & Co. Ltd., 1958. Price £1 5*s*.

This book is intended primarily for amateur entomologists but contains much practical information of value also to more advanced workers. In the first of the three main parts into which it is divided, the author reviews the various types of environment in which insects can be collected, and the apparatus required and the techniques used in catching, rearing, killing and temporarily preserving insects. In the second part, he describes the ways in which insects are prepared and mounted for permanent preservation in a collection, the use of microscopes of different sorts for studying specimens and methods of drawing insects and of photographing preserved specimens, slides and living material. The third part consists of an explanation of the principles of zoological classification and nomenclature, a review of the Orders of insects, with hints on the collection and preservation of each, a key to the Orders, followed by notes on characters useful in insect identification, a survey of the kinds of entomological publications, and notes on the ways in which new facts should be recorded and papers prepared for the press.

Couturier (A.), Gusse (J. F.) & Viel (G.). **Absorption par les vignes du dimefox incorporé au sol.**—*Phytiat.-Phytopharm.* **5** no. 3 pp. 173–178, 2 refs. Paris, 1956.

Dimefox (bis(dimethylamino) fluorophosphine oxide) was tested in Alsace for the control of the root form of *Phylloxera vitifoliae* (Fitch) (*vastatrix* Planch.) on vines. Capsules consisting of 6 cc. 50 per cent. dimefox were used, and one was inserted to a depth of 8 ins. near the roots of each plant on 2nd May, 4th August and 2nd September. The Aphid was not eliminated, since living examples and eggs were found on numerous roots in mid-November, and the leaves of the treated vines, but not the grapes, were scorched, the severity of the injury depending on the variety. Vines growing nearly 5 ft. away from treated ones were also affected. The results of analyses of the leaves and grapes for residues of dimefox are given; they ranged up to 0·28 mg. per kg. in the grapes.

Chaboussou (F.). **Résultats d'essais acaricides vis à vis de** *Bryobia praetiosa* **Koch sur pêcher et de** *Metatetranychus ulmi* **Koch sur pommier en 1955.**—*Phytiat.-Phytopharm.* **5** no. 4 pp. 203–211. Paris, 1956.

In tests in south-western France on the control of the European fruit-tree form (*rubrioculus* (Scheuten)) of *Bryobia praetiosa* Koch *sens. lat.* [*cf. R.A.E.*, A **45** 86] on peach in 1955, sprays prepared from an emulsion concentrate containing 3 per cent. parathion and 70 per cent. oil or a wettable parathion powder were applied at concentrations affording 0·022 per cent. parathion, and demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], a 3:1 mixture of Pyrazoxon [diethyl 3-methyl-5-pyrazolyl phosphate] and Isolan [1-isopropyl-3-methyl-5-pyrazolyl dimethylcarbamate], chlorobenzilate [ethyl 4,4′-dichlorobenzilate], and a related compound termed chloropropylate at 0·025 per cent., on 6th–7th May. Inspection on

20th May showed that demeton and the Pyrazoxon mixture, which possess systemic action, and chloropropylate gave outstanding control. Parathion, especially in the wettable-powder spray, was less effective, and in the emulsion, which had a pronounced ovicidal effect, it scorched the leaves. Chlorobenzilate was not highly toxic and also caused scorching.

In similar tests against *Metatetranychus ulmi* (Koch) on apple, demeton and the Pyrazoxon mixture were applied at 0·025 per cent., Pyrazoxon alone and chlorobenzilate at 0·025 and 0·04 per cent., and chloropropylate at 0·03 and 0·04 per cent., on 12th May. All treatments appeared to give complete mortality of active mites in two days, with no phytotoxic symptoms on the trees, and reinfestation was limited in extent.

Chaboussou (F.) & Ramadier (P.). **La lutte contre les pucerons et les acariens des arbres fruitiers. Essais de nouveaux produits.**—*Rev. Zool. agric.* **55** no. 10–12 pp. 117–133, 4 refs. Talence, 1956.

Tests on the control of fruit-tree pests were continued in south-western France in 1956 [*cf.* preceding abstract]. In those against Aphids, the species were *Anuraphis roseus* Baker (for which the authors use the name *Sappaphis mali* (Ferrari)), *Aphis* (*Medoralis*) *pomi* Deg. and *Eriosoma lanigerum* (Hsm.) on apple, *Anuraphis* (*S.*) *pyri* (Boy.) on pear, and *Hyalopterus pruni* (Geoffr.) on plum, and the dates of treatment ranged from 12th May for *A. roseus* to the end of June for *E. lanigerum*. The systemic sprays tested contained 0·025 per cent. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] or endothion (2-(O,O-dimethyl phosphorothiolomethyl)-5-methoxy-4-pyrone), 0·05 per cent. methyl-demeton [dimethyl 2-(ethylthio)ethyl phosphorothioate] or schradan, 0·025 per cent. of a 3:1 mixture of Pyrazoxon [diethyl 3-methyl-5-pyrazolyl phosphate] and Isolan [1-isopropyl-3-methyl-5-pyrazolyl dimethylcarbamate] or 0·02 per cent. thiometon [O,O-dimethyl S-2-(ethylthio)ethyl phosphorodithioate]. Schradan afforded no mortality of the three apple Aphids, but the other materials all gave complete kill of *Aphis pomi* in 24 hours, and all but demeton gave complete or almost complete kill of *Anuraphis roseus* in 24–48 hours. Demeton, methyl-demeton and thiometon gave complete mortality of *E. lanigerum*, but endothion was ineffective against this species. Endothion gave complete kill of *A. pyri* in five days, and both it and methyl-demeton complete mortality of *H. pruni* in six days. In tests of contact poisons, 0·03 per cent. methyl-parathion and 0·006 per cent. Isolan alone gave complete kill of *A. roseus* and *Aphis pomi* in 24–48 hours, but Isolan was ineffective against *E. lanigerum* and *H. pruni*. Diazinon at 0·02 per cent. and endrin at 0·01 per cent. were ineffective against all species against which they were tested, but 0·02 per cent. parathion in 0·46 per cent. oil emulsion controlled *E. lanigerum*, though slowly. In other work, 0·05 per cent. malathion applied on 1st August 1955 gave complete kill of *A. pomi* and *H. pruni*.

Subsidiary observations on natural enemies of the Aphids showed that Syrphids were killed by demeton, methyl-demeton, the mixture of Pyrazoxon and Isolan, malathion and methyl-parathion, but not by endothion (which was also non-toxic to Coccinellids), thiometon or Isolan alone. The systemic insecticides effective against *E. lanigerum* had no adverse effect on its parasite, *Aphelinus mali* (Hald.).

Tests were also carried out in two localities on the control of the European fruit-tree form (*rubrioculus* (Scheuten)) of *Bryobia praetiosa* Koch *sens. lat.* [*cf. R.A.E.*, A **45** 86] on peach. In one of them, in which sprays were applied on 12th May, 0·025 per cent. demeton or endothion proved very effective and 0·04 per cent. endothion even more so, but 0·05 per cent.

schradan, the other systemic acaricide tested, was less toxic immediately and did not prevent reinfestation after six weeks. Contact sprays of diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] and a material termed chloropropylate at 0·02, 0·027 and 0·025 per cent., respectively, gave satisfactory control for three weeks, after which the counts had to be interrupted. In the other locality, sprays were applied once between 11th May and 19th June; 0·025 per cent. demeton, 0·025 or 0·04 per cent. endothion and 0·05 per cent. methyl-demeton again gave excellent control, but schradan was ineffective, even at 0·075 per cent. The mixture of Pyrazoxon and Isolan gave good results. Of the contact sprays, Aramite at 0·054 per cent. was useless, and diazinon at 0·03 per cent., 1-p-chlorophenyl-2,2,2-trichloroethanol at 0·05 per cent. and chloropropylate at 0·025 per cent. were moderately effective.

Franz (J.). **Über den Frass des Tannentriebwicklers** (*Choristoneura* (*Cacoecia*) *murinana* (**Hb.**)) **an Jungtannen. 1. Beitrag zur Populationsdynamik und biologischen Bekämpfung des Tannentriebwicklers.** [On the Feeding of the Silver-fir Shoot Tortricid (*C. murinana*) on young Firs. 1. Contribution to the Population Dynamics and Biological Control of *C. murinana*.]—*NachrBl. dtsch. PflSchDienst* **8** no. 12 pp. 177–180, 3 figs., 4 refs. Stuttgart, 1956.

Choristoneura murinana (Hb.) is one of the most serious pests of silver fir [*Abies alba*] in Germany, but little is known of the causes of outbreaks and no economic methods of control have been developed. Investigations on the population dynamics of this Tortricid in an area of medium infestation at Gernsbach, in the north of the Black Forest, were therefore begun in 1953, and the results compared with those obtained in an outbreak area near Baden Baden. In this first paper of a series in which they are to be published, the author discusses feeding in spring by the overwintered larvae on young regeneration growth in the forest. Since oviposition and overwintering occur exclusively in the crowns of old trees [*R.A.E.*, A **30** 207], the occurrence of larvae on such young growth is an indication of the extent to which the larvae descend from the trees on which they hatch. The stand at Gernsbach consisted of old trees with young firs ranging up to about 2 ft. in height growing beneath them, and the shoots on the latter were marked and sampled at intervals of five days in May–June, the period during which the larvae are active, in 1954 and 1955. In both years, the percentage of shoots showing feeding damage increased throughout the period, to 29·3 in 1954 and 17·5 in 1955. Not all of these were infested at the time of inspection, and actual infestation reached its peak while the larvae were in the third–fifth instars and then decreased, for which mortality of the older larvae was apparently responsible rather than a movement from one shoot to another. Mortality was apparently not due to parasites [*cf.* **35** 72] or diseases, and predators, principally birds, must have been responsible. As on old trees, only developing buds and shoots of the current year were attacked, and damage to the leading shoot led to its replacement by a side shoot. Such injury was rare, however. A comparison of the degree of defoliation of the young and old trees in the stand showed that the percentage of needles destroyed on the May shoots in 1954 and 1955 averaged 22·1 and 23 for the former and 23·4 and 52 for the latter, so that an increase of damage on the old trees was not accompanied by an increase on the young ones at a time when the food-supply on the former was still abundant.

In the outbreak area near Baden Baden, defoliation of the May shoots increased from 49·5 to 82·2 in the heart of the infested area and from 34·4

to 62·7 at its edges between 1952 and 1955, and damage to regeneration growth was heavy, owing to food shortage on the old trees. The injury to the latter was comparatively more severe, since almost all the shoots were defoliated and many bitten off. Damage was particularly noticeable on three-year-old trees in a forest nursery surrounded by firs 40 years old.

FINKENBRINK (W.). **Über Thiodan, ein neues synthetisches Insektizid.** [Thiodan, a new synthetic Insecticide.]—*NachrBl. dtsch. PflSchDienst* **8** no. 12 pp. 183–185, 1 ref. Stuttgart, 1956.

Thiodan (6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide) is a white crystalline solid consisting essentially of two isomers with different melting points but similar toxicity to insects. The melting point of the mixed isomers lies between 80 and 90°C., and the technical product is about 90 per cent. pure. Tests on insects of agricultural or other importance in various parts of the world showed that Thiodan was effective at 0·02 per cent. in sprays against numerous Aphids, some Lepidoptera, *Acanthoscelides obtectus* (Say), *Psila rosae* (F.) and *Hylemyia antiqua* (Mg.), at 0·03 per cent. against *Locusta migratoria migratorioides* (R. & F.), Psyllids and various Coleoptera, at 0·04 per cent. against *Acheta* (*Gryllus*) *domesticus* (L.), *Typhlocyba rosae* (L.) and *Hylemyia* (*Phorbia*) *brassicae* (Bch.), at 0·06 per cent. against *Philaenus leucophthalmus* (L.) and *Epitrix cucumeris* (Harris) and at 0·1 per cent. against *Calandra granaria* (L.). Effective control of many other pests was also obtained, but effectiveness against spider mites was slight. Dusts proved effective against numerous insects, and a concentrate for mixing with sand or fertiliser gave promising control of Lamellicorn, Tipulid and Elaterid larvae in the soil. Tests with various formulations on a wide range of plants showed that Thiodan is not phytotoxic at normal concentrations. It acts as a nerve poison on warm-blooded animals, the acute LD50 *per os* for white rats being about 40–60 mg. per kg. body weight. Tests with an emulsifiable preparation showed that Thiodan is harmless to honey bees under practical conditions, and larvae of a predacious Syrphid were not affected by 0·03 per cent. Thiodan in an emulsion spray. Potato tubers were not tainted by soil treatment with up to 18 lb. per acre of a concentrate containing 20 per cent. Thiodan, or when the plants were sprayed. Thiodan is less volatile than γ BHC, and though it lost its efficacy in a short time in the laboratory, it remained effective for longer in the field. The vapour phase possesses little toxicity. In emulsifiable preparations or wettable powders, Thiodan was compatible with many fungicides and insecticides, and although it showed some incompatibility with alkalis, mixed alkaline sprays appeared to be satisfactory when applied immediately after preparation.

BUTOVITSCH (V.). **Nyare försök och erfarenheter vid bekämpandet av snytbaggen (*Hylobius abietis* L.).** [Recent Tests and Experiments on the Control of *H. abietis*.]—*Svenska SkogsvFören. Tidskr.* **53** no. 2 pp. 189–200, 7 refs.; also as *Medd. SkogsforsknInst.* Ser. Uppsats. no. 38. Stockholm, 1955. (With a Summary in German.)

Hylobius abietis (L.) has increased in importance in coniferous forests in Sweden since the adoption of clear felling, which leaves large numbers of stumps exposed to the sun, and more effective methods of control than those previously used have become necessary. Investigations on the use as traps of pieces of bark impregnated with an insecticide were begun in 1951, and it was found in that and the following years that parathion was promising for this purpose, since it appeared to attract the beetles, whereas other

materials, including DDT and BHC, either did not or were repellent. Similar results obtained by other workers are reviewed. The disadvantages of the method are that parathion is expensive and highly toxic to warm-blooded animals.

Attention was directed in 1952 to treatment of planting stock with DDT. Gesarol 50, which contains 50 per cent. DDT and leaves a deposit resistant to rain, was diluted to 2 per cent., and young pine stock was immersed in it in bundles for 1–2 minutes and planted in felled areas in April. Bark traps treated with parathion were set out at the same time. Inspection in October showed that 95·2 per cent. of the plants were thriving. How many of the remainder had been destroyed by *H. abietis* was not known, but only 29·3 per cent. of the plants survived in an area in which bark traps but no DDT treatment had been used. In a similar test in 1953, young pine and spruce stock was dipped in 2 per cent. Gesarol 50 in May and planted out, and stumps were sprayed with the same material. When inspected in October, 10·5 per cent. of the plants had been damaged or killed in an area in which stumps had been sprayed alone, whereas there was no attack where the plants had been dipped as well. A phosphorus preparation proved less effective, and the percentage damage for no treatment at all was nearly 40. The persistence of the DDT deposit through the winter was tested by planting treated and untreated pine stock in September 1953 and May 1954, and caging beetles on the plants in June. After ten days, all those on untreated plants were healthy and feeding vigorously, whereas those on the treated ones were dead or paralysed and there were few signs of damage. Further beetles were then released, and the same results were observed in early July. The method gave good protection when applied in practice, and the few failures reported are attributed to faulty dipping technique; the plants should be loosely tied together and immersed for not less than 15 seconds for the best results.

Heqvist (K. J.). **Zur Biologie von** *Hylobius piceus* **De G.** [On the Bionomics of *H. piceus*.]—*Anz. Schädlingsk.* **30** pt. 4 pp. 54–56, 8 figs., 10 refs. Berlin, 1957.

Hylobius piceus (Deg.) infests conifers in various countries, but is not very abundant, and little is known of its life-history. Characters are given distinguishing it from other species of the genus, and its feeding habits are reviewed from the literature [*cf. R.A.E.*, A **14** 104; **25** 375]. Recent observations in a mixed forest of pine, spruce and birch in Sweden showed that oviposition occurred on the upper parts of the main roots and at the base of pine trees 40–100 years old, between mid-June and early or mid-September. No oviposition in stumps was observed. The larvae mined in and beneath the bark, causing frass to appear in the cracks, and pupation occurred mainly in the bark. Some control was afforded by predators, including *Platysoma oblongum* (F.), and some of the eggs were destroyed by resin flow. The adults were taken in numbers on bark traps [*cf.* preceding abstract], were common in felled areas, and injured young spruce plantations by their feeding.

Crooke (M.) & Bevan (D.). **Note on the first British Occurrence of** *Ips cembrae* **Heer (Col. Scolytidae).**—*Forestry* **30** no. 1 pp. 21–28, 1 pl., 1 map, 11 refs. London, 1957.

The following is virtually the authors' summary. During 1955, *Ips cembrae* (Heer) was discovered on larch in 29 localities in Moray, Nairn,

Banff and Inverness, these being the first British records for this Scolytid [*cf. R.A.E.*, A **44** 248]. It is assumed that it entered the country in post-war shipments of timber from Germany and persisted in small numbers until the damage to woodlands caused by the gale in January 1953 provided favourable conditions for its increase. A conspicuous feature of attack is the twig tunnelling of the adults, which produces crown pruning. In one locality, *I. cembrae* succeeded in breeding in and killing standing European larch (*Larix decidua*) of some 45 years of age.

Broadbent (L.). **Investigation of Virus Diseases of Brassica Crops.**—*Agric. Res. Coun. Rep. Ser.* no. 14, vii + 94 pp., 8 pls., 25 figs., 2½ pp. refs. Cambridge, Univ. Pr., 1957.

Virus diseases caused severe losses of cruciferous crops, especially cauliflower, in many parts of England in 1948–50, and a detailed account is given of investigations carried out in 1950–55 with the main purpose of elucidating their mode of spread in the field and methods of control. The principal viruses concerned on cauliflower are cauliflower mosaic and cabbage black ring spot, which are both transmitted by Aphids [*cf. R.A.E.*, A **43** 92].

In this detailed account of the results, the author reviews the cultivation of cruciferous crops in England and Wales, the history of the diseases in Britain, the properties and host range of the two principal viruses, the symptoms that they cause in cauliflower and the effect of sundry factors on them and their transmission, and the following is taken from his summary of the findings. Although many common Aphids can transmit one or both of them, field experiments and observations suggest that *Myzus persicae* (Sulz.) and *Brevicoryne brassicae* (L.) are the only important vectors. Most of the recent severe outbreaks of cauliflower mosaic were associated with the presence of large numbers of *B. brassicae*, which breeds only on crucifers and is most plentiful in summer, soon after winter cauliflowers are transplanted. *M. persicae* is usually more numerous than *B. brassicae* in spring and is important in the transmission of the virus from old crops to seedbeds and newly planted crops. It is sometimes the main vector in summer and autumn.

Periods of fasting before feeding on the infected plant did not increase the capacity of either Aphid to acquire the cauliflower-mosaic virus, and the duration of feeding on the source plant was of little importance. The virus survived for at least three hours in feeding Aphids and occasionally for 24 hours in fasting ones. Aphids acquired cabbage black ring spot most readily after at least 15 minutes' absence from a food-plant [*cf.* **42** 143]. They acquired the virus in ten-second feeding periods, and feeding for more than 15 minutes on the source plant considerably reduced their infectivity, unless they were constantly moving and probing the leaf. The virus was most readily transmitted to a healthy plant when the Aphids were transferred to it immediately. It survived for up to 30 minutes in feeding Aphids and nine hours in fasting ones. When alates of either species reared on infected cauliflower in cages were transferred to seedlings after they had flown from the plants, 15–20 per cent. of those from plants of different ages infected with cauliflower mosaic transmitted the virus, about the same proportion as those from young plants infected with cabbage black ring spot, but Aphids from older plants infected with the latter infected few seedlings.

Cauliflower mosaic is usually the more prevalent of the two viruses in field crops of cauliflower, despite the wider host range and other properties of cabbage black ring spot. The reasons for this are that Aphids can retain the mosaic virus for longer, and that whereas it occurs in high concentrations in all new leaves developed by infected plants, the other virus occurs

mainly in the older, lower leaves and can be detected in young leaves only in recently infected plants [*cf.* **43** 92]. Virus can be spread rapidly from a few infected plants within the crop, so that a crop planted with about 0·5 per cent. of infected seedlings may have 20–40 per cent. of the plants infected at harvest. Most spread occurs before early October, but many plants that are infected in September or later fail to show symptoms until spring, and the yield is thus little reduced. Cauliflower plants infected in July–August usually show symptoms during the autumn, and produce either no saleable curds or only small ones.

Winged Aphids are mainly responsible for virus dissemination, and removing infected plants soon after transplanting resulted in fewer infected plants in the crop, but was uneconomic in a year in which much spread had already occurred. Uninfected seedlings can be grown if the seedbed is placed away from overwintering crops. Relative isolation on a large farm is often just as effective as isolation by a mile or more from known sources. Spraying seedbeds with contact and systemic insecticides did not significantly decrease disease incidence, but insecticides might be useful if Aphids were very numerous, to prevent damage by the feeding of *B. brassicae* and secondary virus spread within the bed. Plant barriers round seedbeds reduced virus incidence by about 80 per cent. Cereals were the best barriers and even single rows sufficed [*cf.* **44** 47]. Spread from crop to crop on farms can be reduced by planting crops of similar age in large blocks, separated from older plantings by as great a distance as possible.

Of the other viruses present, turnip yellow mosaic is transmitted by flea-beetles [*Phyllotreta*] and some other chewing insects [*cf.* **40** 141] and exists in several strains. One affects turnips, mainly in Scotland, and has little effect on other cultivated crucifers, and another, confined to north-eastern England, causes severe losses of cauliflower, cabbage and other crops; many cruciferous weeds are susceptible to both strains. Turnip crinkle has so far been found only on one farm in Scotland. It is transmitted by flea-beetles and by contact, and causes severe stunting of turnips and some cruciferous weeds. Cucumber mosaic virus, which is transmitted by Aphids, causes slight distortion of turnip leaves, but no symptoms on most other cultivated crucifers.

Taylor (L. R.). **Temperature Relations of teneral Development and Behaviour in *Aphis fabae* Scop.**—*J. exp. Biol.* **34** no. 2 pp. 189–208, 6 graphs, 24 refs. London, 1957.

Johnson (C. G.) & Taylor (L. R.). **Periodism and Energy Summation with special Reference to Flight Rhythms in Aphids.**—*T. c.* pp. 209–221, 7 graphs, 13 refs.

These two papers form part of a series [*cf.* also *R.A.E.*, A **46** 148] in which are analysed the results of observations made in July 1952 on the teneral stage of the alates of *Aphis fabae* Scop. on field beans [*Vicia faba*] in a walled garden in southern England. The following is based largely on the author's summary of the first paper. The teneral stage in *A. fabae* is defined as the interval between eclosion of the adult alate and flight when the latter is not extrinsically activated or inhibited. During it, the Aphids move to a sheltered site on the plant and insert their stylets, though it is not known whether they feed, and their wings expand, and it is terminated by withdrawal of the stylets, movement to a suitable take-off point, and flight. The mean duration of the teneral stage was determined from data obtained at frequent intervals during each day by marking alates in batches as they moulted and at the same time recording the numbers that had flown since the previous inspection. Analysis of these data, after the elimination

of any in which flight appeared to have been affected by a behaviour response, and of data obtained when newly emerged alates were caged at constant and varying temperatures in the laboratory established that the velocity of development during the teneral period (expressed as percentage of development completed per hour) is logistically related to temperatures between 10 and 30°C. [50 and 86°F.] and that inherent individual variations, comprising a constant proportion of teneral time at all temperatures, are imposed upon this trend. Wind speed, relative humidity and rate of change of temperature had a negligible effect on rate of development during the teneral stage. Catches in a suction trap that was operated in the middle of the plot just below crop level indicated that take-off is inhibited when temperatures at a height of 1 ft. in the crop fall below about 16°C. [60·8°F.] and at light intensities below about 100 foot-candles [*cf.* **37** 484], and these behaviour responses at the end of the teneral stage sometimes appear to prolong it. That unstimulated flight provides a good criterion of the end of the teneral stage and is not related to migration was confirmed by observations on newly emerged adults of *Aglais urticae* (L.) in its autumn, non-migratory phase, which resembled the Aphid both in behaviour and in the relation between teneral period and temperature.

The following is taken almost entirely from the authors' summary of the second paper. Summer populations of *Aphis fabae* often show a bimodal flight curve with no flight at night [*cf.* **41** 120; **44** 398; **46** 148]. As the temperature rises during the day, the teneral period of the newly moulted alates becomes shorter, and the resultant increase in the rate of take-off causes an afternoon peak. The morning peak is usually due to the accumulation, until rising temperatures permit flight, of Aphids that have matured overnight. A graphical method is given for constructing flight curves from constant or observed moulting rates and the temperature during the teneral period.

Laughlin (R.). **Absorption of Water by the Egg of the Garden Chafer, *Phyllopertha horticola* L.**—*J. exp. Biol.* **34** no. 2 pp. 226–236, 5 figs., 13 refs. London, 1957.

The following is virtually the author's summary. The egg of *Anomala* (*Phyllopertha*) *horticola* (L.), which is laid in the soil [*cf. R.A.E.*, A **44** 185], absorbs nearly twice its own weight of water in the early stages of the incubation period. The chorion is thin, uniform and elastic, and the surface is covered with granules. Several layers of epembryonic cuticle are added as the embryo develops. These layers are resorbed before hatching takes place. The rate of development, the rate of water uptake and the length of the rapid absorption period are affected to equal degrees by temperature. Eggs are most easily desiccated in the rapid absorption period. The yolk of the new-laid egg has an osmotic pressure of about 13 atmospheres. The extra-embryonic fluid of the swollen egg has an osmotic pressure of about eight atmospheres. Eggs absorb little or no water from sucrose solutions with osmotic pressures of 15 atmospheres or over. New-laid eggs cannot absorb water from air at 98 per cent. relative humidity or less. Swollen eggs placed in air of this humidity collapse and die.

Frazier (N. W.) & Posnette (A. F.). **Transmission and Host-range Studies of Strawberry Green-petal Virus.**—*Ann. appl. Biol.* **45** no. 4 pp. 580–588, 2 pls., 9 refs. London, 1957.

Strawberries in Britain have for many years been attacked by a virus disease, designated green-petal, that causes bronzing of the leaves, stunting,

proliferation of the crown, elongation and subsequent wilting of the thalamus, and the production of flowers with small, green petals. It has only recently been distinguished from the wilt caused by *Verticillium* spp. In previous work, insects did not transmit this disease, but in view of the recorded resistance of strawberry to infection with aster-yellows virus, alternative host-plants that might prove more susceptible than strawberry were used in further attempts to obtain transmission.

A condition known as phyllody or virescence has long been known in clover, and a virus was transferred experimentally by means of dodder (*Cuscuta*) from infected red clover [*Trifolium pratense*] growing near infected strawberry to *Fragaria vesca* and *Duchesnia indica*, both of which later developed symptoms of the green-petal disease. Vector trials were begun at the same time, and the Cicadellids, *Euscelis lineolata* Brullé and *Macrosteles viridigriseus* (Edw.), infected clover and mayweed (*Anthemis cotula*) with the virus causing phyllody in clover and plantain (*Plantago major*), respectively. *Euscelis* and *Macrosteles* spp. can be identified only by dissecting the males; males of *Euscelis* that transmitted virus when tested singly were determined as *E. bilobata* Wagner, *E. galiberti* Ribaut and *E. lineolata*, but these are regarded by some as forms of *E. plebeja* (Fall.). Three virus-free colonies of *E. lineolata* were obtained. One of them was reared on oats from infective parents in the winter of 1955–56, but examples from colonies raised on barley and wheat infected clover without first feeding on an infected plant; it is not known whether these plants are hosts of the virus or whether infection is transmitted through the eggs of the Cicadellids [*cf. R.A.E.*, A **44** 139, etc.]. Two viruses or strains were distinguished, of which one caused phyllody and the other witches' broom on clover. *M. viridigriseus* appeared to be relatively ineffective as a vector; the adults transmitted phyllody only when reared on infected plants and witches' broom only when infected in the field prior to collection. *E. lineolata* proved more effective. It transmitted the viruses to and from numerous plants and from but not to strawberry. The nymphs acquired infection during a feed lasting two days, there was a latent period of about 30 days in the vector, and the infections persisted in the latter for a long period, probably for life.

The manner in which strawberry plants become infected with the green-petal disease in the field is not known, but the presence of large numbers of the vectors may be necessary. In Britain, grass and clover, the preferred food-plants of these insects, are always available and there is relatively little migration to crop plants. The annual incidence of green-petal disease is usually 2–5 per cent., and heavier infections are the result of unusual circumstances, such as the proximity of high Cicadellid populations on infected weeds or clover or heavy migration to the crop, especially if irrigated, from wild food-plants in time of drought. Variations in the symptoms produced on strawberry plants infected naturally and experimentally through dodder suggested that two diseases have hitherto been grouped under one name. It is proposed to distinguish the green-petal disease, caused by the virus inducing phyllody in clover, from one designated bronze-leaf wilt, caused by the witches'-broom virus of clover, in which green petals do not develop.

Hollings (M.). **Investigation of Chrysanthemum Viruses. II. Virus B (Mild Mosaic) and Chrysanthemum Latent Virus.**—*Ann. appl. Biol.* **45** no. 4 pp. 589–602, 1 pl., 11 refs. London, 1957.

The following is based partly on the author's summary of this paper, which forms part of a series [*cf. R.A.E.*, A **43** 280]. Chrysanthemum virus B, which has been reported from Holland and the United States [*cf.* **42**

364], was found to be widespread in chrysanthemum stocks in Britain but appears to do little damage; it caused very slight or no symptoms in 34 varieties tested. The name mild mosaic is proposed for the disease, and the properties of the virus and the symptoms induced are described. The virus was transmitted to ten out of 86 species of plants by mechanical inoculation and grafting, and caused local lesions in petunia. Chrysanthemum was difficult to infect by mechanical inoculation, and the virus was not spread by leaf contact or by knives used for taking cuttings. It was transmitted from chrysanthemum to chrysanthemum in tests by *Myzus persicae* (Sulz.), *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.), *M.* (*Aulacorthum*) *solani* (Kalt.), *M.* (*Macrosiphoniella*) *sanborni* Gill., and *Rhopalosiphum* (*Coloradoa*) *rufomaculatum* (Wils.) [*cf.* **42** 365], but not by *Anuraphis padi* (L.) (*Brachycaudus helichrysi* (Kalt.)). Pre-starvation for three hours increased transmission by *M. sanborni* in one test, and *Myzus persicae* remained infective for up to 45 minutes when transferred to a fresh chrysanthemum plant every 15 minutes and for up to an hour when prevented from feeding. The virus is thus of the non-persistent type.

Two hitherto unrecorded viruses that also caused local lesions in petunia were observed in chrysanthemum in the course of the work. One of them, vein mottle, was widespread and similar in some ways to virus B, including its transmission by Aphids (*Macrosiphum sanborni*), but virus B did not protect against it, and the other, chrysanthemum latent virus, the properties of which are described, was not transmitted by the cutting knife, root contact or two species of Aphids tested (*M. sanborni* and *Myzus persicae*) and seemed to be of no importance.

Broadbent (L.), Heathcote (G. D.), McDermott (N.) & Taylor (C. E.). **The Effect of Date of Planting and of Harvesting Potatoes on Virus Infection and on Yield.**—*Ann. appl. Biol.* **45** no. 4 pp. 603–622, 6 graphs, 12 refs. London, 1957.

The following is virtually the authors' summary. Experiments were made in central England in 1953–56 to test the effects of early and late planting of King Edward potatoes on the incidence of virus diseases in the tubers and the suitability of the tubers for use as seed. Plantings were made each month from April to August, and tubers were lifted after 12 weeks' growth or after the haulms had died.

Aphids, principally *Myzus persicae* (Sulz.) and *Macrosiphum solanifolii* (Ashm.), began to colonise the early-planted plots about mid-June each year, but their multiplication and flying were influenced by weather and varied greatly from year to year. The May-planted plots usually bore most Aphids. Winged Aphids visited the July and August plantings, but few bred extensively, though the plants were young and green. The incidence of virus diseases in the tubers was not related to the maximum Aphid populations on the plants. Most of the plants that became infected became so by Aphids flying from diseased potato plants in the same field, and the late-planted plots did not escape. Crops planted in mid-April and harvested in early July produced the fewest virus-infected tubers.

Planting in April and lifting at the end of the season produced most ware-sized tubers. In plots lifted after 12 weeks, May or June planting produced more ware than April planting. Few or no ware-sized tubers were produced from July or August planting, and yields of seed-sized tubers also were poor. Most seed-sized tubers were produced by the late-lifted May or June plantings. The date of lifting had little effect on the total number of tubers, but the date of planting affected it greatly. Most tubers were usually set

by the May plantings, and the number decreased with successive planting dates.

Early-lifted immature tubers were easily damaged and were difficult to store. Blighted tubers occurred only in the July or August plantings, which also suffered most from slug and cutworm damage.

Infection with leaf-roll virus reduced yield by about three-quarters, whether the seed had been lifted early or late the previous year. Healthy or virus-infected mature seed produced a bigger crop the next year than immature seed obtained by early lifting or late planting. Late-planted tubers produced more main stems than those planted at the normal time, but growth of axillary shoots was reduced and total leaf area remained small, even when the plants were not attacked by blight.

Johnson (C. G.), Taylor (L. R.) & Haine (E.). **The Analysis and Reconstruction of diurnal Flight Curves in Alienicolae of *Aphis fabae* Scop.** —*Ann. appl. Biol.* **45** no. 4 pp. 682–701, 6 graphs, 13 refs. London, 1957.

Johnson (C. G.), Haine (E.), Cockbain (A. J.) & Taylor (L. R.). **Moulting Rhythm in the Alienicolae of *Aphis fabae* Scop. (Hemiptera: Aphididae) in the Field.**—*T. c.* pp. 702–708, 1 graph, 4 refs.

Further results are given in these two papers of observations in July 1952 on alates of *Aphis fabae* Scop. in the teneral stage on field beans [*Vicia faba*] in southern England [*cf. R.A.E.*, A **46** 144]. The following is based partly on the authors' summary of the first. Experiments in which alates were marked immediately after eclosion from the last nymphal instar and observed until they took flight gave information that was used, together with the measured rate of moulting and a continuous record of temperature, to construct theoretical daily curves for numbers flying from the crop. These were matched against curves based on catches in a suction trap for the same days. The differences between the two sets of curves were of the same order and kind as the differences between two measured curves for different sites at the same sime. It is concluded that the different types of daily flight curve can be accounted for in terms of the rate of production of alates by moulting, the effect of temperature on the teneral period and the effect of low light intensity and temperature on take-off behaviour [*cf.* **46** 145]. If temperatures remain high for two successive days, a bimodal curve results, but if they are low, the curve becomes irregular because of their effect on moulting rate, teneral period and take-off behaviour. Ambient temperatures of 15–20°C. [59–68°F.] during the day further delay flight, as also may high wind, and below about 15°C. flight is altogether inhibited. Flight activity ended early in the day in the sheltered garden in which the observations were made, almost certainly owing to reduced light, but flight from the summer food-plant in July may normally be expected to continue until 8–10 p.m. G.M.T.

The following is based on the authors' summary of the second paper. Observations in which newly moulted alates of *A. fabae* on 48 numbered and tagged bean leaves were counted and removed at approximately hourly intervals throughout each day showed that the frequency of moulting was usually relatively high between about 4 and 8 a.m. G.M.T. This high rate was followed by a decline to a lower fluctuating rate for the rest of the day. The moulting rate at night was usually very low. The high rate of moulting in the morning, just as the temperature is rising, may be due to acceleration of nymphal development, which leads to a synchronisation of moulting, much as teneral development of alates, if accelerated, produces flight peaks

during the day [**46** 145]; data on the relations of moulting and nymphal development to temperature are, however, insufficient for making a complete analysis along these lines. Changes in the moulting rate during the rest of the day are correlated with temperature and with time, both independently. A rise of 1°C. [1·8°F.] in ambient temperature is associated with a rise of 11·6 per cent. in moulting rate, a fall of 1°C. with a drop of 10·5 per cent., and a lapse of one hour in time by a fall of 5·4 per cent. Sunshine and relative humidity show no simple correlation with moulting rate.

Williams (G. C.). **Comparative Tests of the Effectiveness of DDT and BHC Dusting Powders against the "Hide or Leather Beetle," *Dermestes maculatus* Degeer (Col. Dermestidae).**—*J. Soc. Leath. Tr. Chem.* **40** pp. 253–258, 2 refs. London, 1956.

Cooked bones stored in bulk in a shed in Britain for manufacture into bone meal were heavily infested by *Dermestes maculatus* Deg., which also damaged the roofing timbers. Mixing 5 per cent. DDT dust with the bones as they were introduced gave little or no control, and the toxicity of DDT and γ BHC to adults and larvae was therefore investigated in the laboratory. The insects were exposed for 6–96 hours to dust deposits of 5 per cent. DDT or 0·5 per cent. γ BHC in closed petri dishes at 25°C. [77°F.] and 75 per cent. relative humidity, and then transferred to clean tubes and observed for up to 120 hours. All the adults were dead on removal from contact with DDT for 48 hours or γ BHC for 24, and all died in 96, 48 and 72 hours after exposure to DDT for 24, 12 and 6 hours, respectively, and in 24 hours after exposure to γ BHC for 6 or 12 hours. DDT was ineffective against the larvae, and γ BHC so slow in action that the highest mortality recorded (60 per cent. 96 and 120 hours after exposure for 24 and 6 hours, respectively) was almost equalled in the untreated controls.

Bezant (E. T.). **First Records of *Trogoderma boron* Beal (Col., Dermestidae) in Britain.**—*Ent. mon. Mag.* **92** no. 1107 p. 308. London, 1956.

Trogoderma boron Beal, which was described in 1954 [*R.A.E.*, A **44** 64], was recorded in Britain for the first time in September 1955, when living adults were taken on cottonseed meal from Texas in ships at two ports. This Dermestid is probably indigenous in the north-western United States, where it is widely distributed and of potential importance as a pest of stored grain.

Carnegie (A. J. M.). **The Effects of varying Temperatures on the Rate of Emergence of Adult Male Mussel Scale (*Lepidosaphes beckii* Newm.) (Hem., Coccidae).**—*Ent. mon. Mag.* **92** no. 1107 pp. 311–312, 1 graph. London, 1956.

The daily emergence of males of *Lepidosaphes beckii* (Newm.) from infested *Citrus* material kept in the laboratory in South Africa in March–April 1954 was found to fluctuate with the temperature and was low at temperatures below about 70°F. A sudden rise was accompanied by the appearance of large numbers of males, which had evidently been fully mature for some time. On the second of two consecutive hot days, emergence was relatively low, since most males had appeared on the first. A

similar fluctuation was observed in cages in the open, where large emergences were correlated with high maximum temperatures.

Parkin (E. A.), Scott (E. I. C.) & Varley (E. R.). **The insecticidal Effect of Nigerian Diatomite.**—*Colon. Pl. Anim. Prod.* **5** (1955) no. 3 pp. 201–207. London, 1956.

Trogoderma granarium Everts and *Tribolium castaneum* (Hbst.) are serious pests of stored groundnuts in northern Nigeria, and the former is particularly difficult to control. Finely divided alumina and other inert dusts gave rapid kill of *Trogoderma* larvae in the laboratory at 30°C. [86°F.] and 30 per cent. relative humidity, such as occur for parts of the year in the region, but would be difficult to apply there, particularly to pyramidal stacks of bagged groundnuts in the open, because of the high winds that occur. The dried deposit from an aqueous suspension of a proprietary colloidal silica preparation, applied to the internal walls of a granary, had proved very effective against stored-product pests, predominantly *Oryzaephilus surinamensis* (L.), and showed no signs of caking, but was expensive, and tests were therefore made to compare the effectiveness of this preparation and several fractions of a Nigerian diatomite, to assess the potentialities of the latter for local use in protecting stored produce. The tests were made with adults of *Calandra granaria* (L.), *C. oryzae* (L.) and *Tribolium castaneum*, and the finest fraction of diatomite, which contained a very large proportion of particles in the range 3μ–10μ, though less effective than the silica, gave good control at 25°C. [77°F.] and 70 per cent. relative humidity when applied as a dust, but failed, because of caking of the dried deposit, when applied in aqueous suspension to bricks, though the dry deposit of colloidal silica was effective under these conditions.

Duerden (J. C.). **Infestation of undecorticated Groundnuts by** *Trogoderma granarium* **Everts.**—*Colon. Pl. Anim. Prod.* **5** (1955) no. 3 pp. 208–210, 1 ref. London, 1956.

Bags of unshelled groundnuts stacked in a heap in the open at Kano, northern Nigeria, in November 1952 were found a year later to be infested by large numbers of larvae of *Trogoderma granarium* Everts. Active adults and larvae were observed at the base, on several bags extending up the exposed surfaces, and at the top of the stack. Examination of the contents of a heavily infested bag from the layer immediately below the top showed that 70 per cent. of the pods were whole, 26 per cent. had split or cracked shells and 4 per cent. had shells punctured with a hole 1–2 mm. in diameter. The insects had evidently entered by these holes, which gave free access to the kernels, and holed pods averaged 20 per cent. less in weight than sound ones. The holes were not evenly distributed over the pod surfaces, 72 per cent. occurring at the distal end, and this suggests that they had been made by insects in the field and used subsequently by *Trogoderma*. Examination of random samples showed that sound pods were free of insects, whereas 31·7, 4·2 and 0·8 per cent. of the broken pods were damaged by *T. granarium*, *Tribolium castaneum* (Hbst.) and *Ephestia cautella* (Wlk.), respectively, 1·6 per cent. by termites and 2·5 per cent. by unidentified species, and 66·6 and 5 per cent. of the holed pods were damaged by *Trogoderma* and *Tribolium* and 1·7 per cent. by termites followed by *Trogoderma*. As 59·2 and 26·7 per cent. of broken and holed pods, respectively, had no damaged kernels and contained no cast larval skins or frass to indicate the earlier presence of *T. granarium*, it seems likely that the infestation was secondary rather than primary.

Schmitz (G.). **Les termites et les moyens de les détruire.**—*Bull. agric. Congo belge* **47** no. 6 pp. 1551–1596, 2 col. pls., 11 figs., 84 refs. Brussels, 1956. (With a Summary in Flemish.)

This is a detailed review of the habits and control of termites, with special reference to conditions in tropical Africa. It is based very largely on the literature, but includes the results of some original work in the Belgian Congo. Against *Macrotermes goliath* (Sjöst.), the introduction of p-dichlorobenzene, suspensions or emulsions of aldrin or emulsions containing parathion into the nests gave good results, and D-D mixture [1,3-dichloropropene and 1,2-dichloropropane] proved very effective when similarly applied. Cotton was completely protected against *Ancistrotermes* by dusting the drills with 2 per cent. dieldrin before sowing or the collars and bases of the stems of the plants with 10–15 per cent. BHC, 2 per cent. dieldrin or 2 per cent. methyl-parathion. For the protection of timbers in buildings from termites, treatment of the wall bases and surrounding soil with 10–15 per cent. BHC powder gave good results. Posts impregnated with a mixture of 5 per cent. BHC and 5 per cent. pentachlorophenol, alone or with unspecified chloronaphthalenes, in a volatile solvent, were not attacked for 1–2 years or longer. Some native timbers are resistant to attack, and lists of these are given.

Foucart (G.) & Brion (L.). **Essais d'insecticides mixtes dans la lutte contre** *Antestiopsis* **et** *Habrochila* **parasites du caféier d'Arabie.**—*Bull. INEAC* **5** no. 6 pp. 385–397, 9 graphs, 1 ref. Brussels, 1956.

Since the application of DDT to coffee in the Belgian Congo for the control of *Antestiopsis lineaticollis* (Stål) leads to outbreaks of *Habrochila ghesquièrei* Schout., and parathion, which is effective against the latter, is unsatisfactory against the former and dangerous to apply in mist sprays, substitutes for these insecticides were tested in the laboratory [*cf. R.A.E.*, A **45** 119]. In this paper, experiments with combined sprays of DDT and phosphorus insecticides are recorded.

In laboratory tests against *A. lineaticollis*, sprays of 0·1 per cent. DDT with 0·02–0·06 per cent. diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate], 0·02–0·12 per cent. malathion or 0·02–0·04 per cent. Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl phosphorothioate], or the same insecticides singly, were tested. When the insects were confined for ten minutes with sprayed coffee berries that had been allowed to dry and were then transferred to unsprayed ones, the most effective concentration of diazinon in a mixed spray was 0·04 per cent., and lower concentrations were more effective than higher ones. Similar results were obtained with the other mixed sprays, the most effective concentrations being 0·05 per cent. for malathion and 0·04 per cent. for Chlorthion. When the insects were confined continuously with berries sprayed 24 or 48 hours previously, mortality increased with the concentration of diazinon, malathion or Chlorthion, except that 0·04, 0·05 and 0·06 per cent. diazinon gave about the same results. Mixtures of DDT and malathion were more and those of DDT and Chlorthion less effective than mixtures of DDT and diazinon. When the mixtures were compared with the insecticides used singly in the ten-minute test at the same concentrations, the mixtures containing 0·02–0·04 per cent. diazinon were more effective than DDT alone at 0·1 per cent. or than diazinon at 0·04 per cent., all the malathion mixtures but that containing 0·12 per cent. were more effective than DDT and than malathion alone at the same concentrations, and all the Chlorthion mixtures were less effective than DDT alone or than Chlorthion at 0·04 per cent.

alone. In the tests with berries sprayed 24 or 48 hours previously, all the malathion mixtures were superior to DDT alone or malathion alone at the same concentrations. Mixtures with 0·05 or 0·06 per cent. diazinon were superior to DDT alone or diazinon alone after 24 hours, but about equal to DDT after 48, the Chlorthion mixtures were superior to Chlorthion alone, and those containing 0·03–0·05 per cent. Chlorthion were superior to DDT alone.

In a field test against *H. ghesquièrei*, sprays of 0·1 per cent. DDT with 0·0125–0·15 per cent. diazinon, 0·0125–0·075 per cent. malathion, 0·00625–0·05 per cent. Chlorthion or 0·0125–0·025 per cent. parathion were applied at about 80 gals. per acre, and insect counts were made 14–35 days later. The percentage reductions in populations after 14 days and (in brackets) over the whole period were 100 (95·6) and 100 (100) for mixtures containing 0·05 and 0·15 per cent. diazinon, respectively, 100 (98·3) and 83 (92·2) for those containing 0·025 and 0·05 per cent. malathion, 97 (94·6) and 100 (99·8) for those containing 0·025 and 0·05 per cent. Chlorthion, and 70 (73·9), 100 (100) and 100 (84) for those containing 0·0125, 0·0175 and 0·025 per cent. parathion, as compared with none in the controls.

It is concluded that a mixture of 0·1 per cent. DDT and 0·05 per cent. malathion is the best against *A. lineaticollis* and that it affords satisfactory control of *H. ghesquièrei*.

Entomology Report.—*Rep. W. Afr. Maize Res. Unit 1954* p. 30, 1 col. fldg. map (in pocket). Ibadan [?1957].

In connection with studies on the resistance of strains of maize to Noctuid stem borers in West Africa, a map prepared by J. Bowden and W. R. Stanton is given showing the areas in which *Sesamia poephaga* Tams & Bowden, *S. botanephaga* Tams & Bowden, *S. calamistis* Hmps. and *Busseola fusca* (Fuller) cause economic damage to maize in Ghana, with the various vegetation zones.

Lodos (N.). **Türkiye'de yeni bulunan iki hububat zararlısı *Scatopse nigra* Meig. (Diptera) ve *Hemitrama bykovi* Mordwilko (Hemiptera).** [Two Pests of Cereals new to Turkey, *S. nigra* and *H. bykovi*.]—*Ege Univ. Zir. Fak. Calişm.* no. 1, 11 pp., 8 figs., 10 refs. [?Smyrna] 1957. (With a Summary in English.)

Scatopse nigra Mg. and *Hemitrama bykovi* Mordv. were found in Turkey for the first time in 1956, near Smyrna. *Scatopse*, the larva, pupa and adults of which are described, infested barleys growing in selection plots, and caused economic damage on some varieties. The adults were present from about March until mid-June, and the eggs were laid on the young ears. The larvae fed in the grains, affecting their appearance and quality, and pupated on their exterior. Infestation was most severe on close grained varieties, reaching 71 per cent. in 1957. *Hemitrama* (an Aphid) infested the roots of wheat at an agricultural college.

Ehara (S.). **Tetranychoid Mites of Mulberry in Japan.**—*J. Fac. Sci. Hokkaido Univ.* (6) **12** no. 4 pp. 499–510, 32 figs., 15 refs. Sapporo, 1956.

Six Tetranychids and one Phytoptipalpid are here recorded as infesting mulberry in Japan. One of the former is the species referred to in the literature as *Panonychus mori* Kishida [*cf. R.A.E.*, A **23** 131], but as

Kishida published no description of it, it should be credited to Yokoyama, who described it in 1929 and thereby validated the monobasic genus *Panonychus*. As examination of Yokoyama's syntypes showed that *P. mori* is a synonym of *Metatetranychus citri* (McG.), *Metatetranychus* (1931) is congeneric with *Panonychus*. The correct name for the species is therefore *Panonychus citri*, and that for the European red mite (*M. ulmi* (Koch) [*cf.* **44** 19]) is *P. ulmi*. *P. citri* is recorded from mulberry in Hokkaido, Honshu and Kyushu. The other Tetranychids are *Eotetranychus suginamensis* (Yokoyama) [**21** 199; **44** 19] and *Tetranychus kanzawai* Kishida [**15** 462], of which both are described and recorded from Hokkaido and Honshu, the first infesting mulberry and *Quercus serrata* and the second mulberry, tea, hops, vines, *Robinia pseudacacia*, pear, peach and apple, *T. telarius* (L.), which infests mulberry and tea and occurs in Hokkaido and Honshu, a carmine form of the complex of *T. telarius* that was included by Yokoyama in his *T. kanzawai* and is here described as *T. truncatus*, sp. n., from mulberry in Honshu, and a species referred to as *Tacebia parva* Yokoyama, the identity of which is uncertain as the types are lost. The Phytoptipalpid is *Brevipalpus inornatus* (Banks), which is described and recorded from Honshu and Kyushu, on tea, *Erigeron*, *Pittosporum* and tulip bulbs, in addition to mulberry.

Wyatt (I. J.). **Pot Experiments on the insecticidal Control of Padi Stemborers.**—*Bull. Dep. Agric. Malaya* no. 101, 29 pp., 5 graphs, 4 refs. Kuala Lumpur, 1956.

The Pyralids, *Chilotraea polychrysa* (Meyr.), *Chilo suppressalis* (Wlk.) and *Schoenobius incertulas* (Wlk.), and the Noctuid, *Sesamia inferens* (Wlk.), which bore in the stems of rice, are the most serious pests of that crop in Malaya, where they breed continuously throughout the year and so cannot be controlled by applying insecticides at the time of egg-laying, as is done elsewhere. Pot experiments were therefore carried out in 1953–55 to determine the effect of treatments applied weekly or at various intervals after transplanting. EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate] and dieldrin were applied at 0·5 lb. per acre in wettable-powder sprays in the first test, endrin and dieldrin at 0·5 lb. per acre in emulsion sprays in the second, and dieldrin at 1 lb. per acre in an emulsion spray in the third, and the following is based on the author's summary of the results.

The interrelationship between the four insect species and the developing rice plants was complex. The three insecticides were about equally effective in reducing the number of larvae in the stems, but dieldrin is preferred on account of its low toxicity to man and other vertebrates. Time of application was found to be most important, and the third experiment, in which dieldrin was applied once 4–8 weeks after transplanting, showed that there is a pronounced optimum time. This was six weeks after transplanting for the short-term variety of rice used, and earlier and later applications were markedly less effective. The plants appeared to be most vulnerable to attack just before ear emergence, only tillers that had not been infested by this time producing ears, though some of those attacked later subsequently produced empty ones, usually because of damage to the flowering stem. When the moths were abundant, the intensity of attack appeared to be regulated by the stage of growth of the plants. The insecticides were effective against the Pyralids, but not against *S. inferens*, which oviposits beneath the leaf sheaths, so that the larvae are at no time exposed. This species apparently selects unbored tillers, and may affect almost all tillers by harvest, in spite of heavy insecticide applications, but infestation by it, especially at a late

stage, appears to be less harmful than that by the Pyralids. Under some conditions, borer attack may induce extra tillering and ear production, but this compensates little for the initial losses.

The effect of the treatments on incidental pests that appeared on the plants is discussed in one appendix, and it is shown in another that EPN and dieldrin applied at 0·5 lb. per acre would probably be toxic to *Lebistes reticulatus* and other fish of economic importance that live in the water in the rice-fields in many districts of Malaya.

Viado (G. B.), Punzalan (E. C.) & Banaag (A. F.). **Control of Tobacco Insects with Organic Insecticides.**—*Philipp. Agric.* **40** no. 7 pp. 361–377, 4 figs., 13 refs. College, Laguna, 1956.

Field tests on the control of insect pests of tobacco were carried out in the Philippines in two seasons [*cf.* also *R.A.E.*, A **46** 107]. The leaf-feeding insects present were *Heliothis armigera* (Hb.), which was the most important, *Prodenia litura* (F.), *Plusia chalcites* (Esp.), *Oecanthus indicus* Sauss. and *Phaneroptera furcifera* Stål, and the sprays contained 1·5 lb. 10 per cent. wettable γ BHC, 2 or 4 lb. 50 per cent. wettable DDT, 1·5 lb. 25 per cent. wettable EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate], 2 lb. 50 per cent. wettable methoxy-DDT (methoxychlor), 2·5 lb. 40 per cent. wettable toxaphene or 1 U.S. pint emulsion concentrate containing 60 per cent. toxaphene, 19·5 per cent. endrin or 15 per cent. dieldrin, all per 100 U.S. gals.

In one locality in 1955–56, six applications were made at ten-day intervals, beginning about two months after transplanting, when about half the plants showed insect damage, and the percentages of leaves uninjured on 9th March and (in brackets) 18th April, about a week before the final picking, were about 68 (76) for DDT at 2 lb., 62 (65) for dieldrin, 62 (70) for emulsifiable toxaphene, 58 (60) for γ BHC and 48 (49) for methoxy-DDT, as compared with 41 (54) for no treatment. All insecticides but methoxy-DDT gave significant control on the first date, and all but methoxy-DDT and γ BHC on the second. In 1954–55, sprays were applied three times at fortnightly intervals or six times at weekly intervals, and the percentages of undamaged leaves were about 34 and 73, respectively, for DDT at 2 lb., 23 and 71 for dieldrin, 17 and 72 for emulsifiable toxaphene, 4 and 11 for γ BHC and 9 and 12 for methoxy-DDT, as compared with 5 for no treatment.

In another locality in 1955–56, four applications were made at fortnightly intervals, beginning about two months after transplanting, when insects were abundant and damage was already considerable. Owing to the continuous production of leaves, not all received four applications, and the results were based on the total number of leaves receiving three successive sprays. The percentages undamaged were then about 32 and 42 for DDT at 2 and 4 lb., respectively, 39 for endrin, 23 for EPN and 37 for wettable toxaphene, as compared with 10 for no treatment. All insecticides gave significant control. In none of the tests was there a significant increase in yield, indicating that insect damage was light. Slight scorching was caused by γ BHC, but it disappeared in a few days.

In laboratory tests, larvae of *H. armigera*, *Prodenia litura* and *Plusia chalcites* and nymphs and adults of *Phaneroptera furcifera* were confined on sprayed tobacco leaves and mortality estimated at intervals of 24 hours. The Lepidopterous larvae were all killed by DDT at 2 lb. in 96 hours, by dieldrin in 120, 96 and 72 hours, respectively, by toxaphene in 120, 120 and 96 hours, by γ BHC in 168, 120 and 120 hours, and by methoxy-DDT in 168, 144 and 144 hours. The periods for complete kill of adults and nymphs of *Phaneroptera* were 120 and 96 hours for 2 lb. DDT, 48 hours for dieldrin,

48 and 72 hours for toxaphene, 72 and 96 hours for γ BHC and 168 and 144 hours for methoxy-DDT. There was no mortality in the controls. Dieldrin was slightly repellent to all species and γ BHC to some of them.

KROON (A. H. J.). **South Pacific Commission Technical Paper no. 101. Erratum.**—1 p., multigraph. Nouméa, 1957.

It is stated that the author of a paper recently noticed, on the parasites and predators introduced into the Pacific islands for the biological control of insects and other pests [*R.A.E.*, A **45** 410], was not C. P. Hoyt, whose name appeared on it, but L. J. Dumbleton, though Hoyt corrected Dumbleton's manuscript and brought it up to date.

BRADLEY (R. H. E.). **Effects of Depth of Stylet Penetration on Aphid Transmission of Potato Virus Y.**—*Canad. J. Microbiol.* **2** pp. 539–547, 13 refs. Ottawa, 1956.

Many Aphid-borne plant viruses are readily acquired and transmitted during only brief attempts to feed by their Aphid vectors, and recent evidence indicates that such viruses are acquired from and transmitted to the epidermal layer of the plant [*cf. R.A.E.*, A **43** 129, 302; **45** 367]. Tests to confirm this view were carried out with *Myzus persicae* (Sulz.) transmitting potato virus Y from and to tobacco, and the following is substantially the author's summary of the results. The Aphids most often became infective on inserting the stylets only superficially into infected tobacco plants after a period without food; the further the stylets penetrated into the plant, the less likely were the Aphids to become infective. When epidermis was removed from infected plants, the Aphids acquired virus Y as readily from the exposed mesophyll as from the piece of removed epidermis. It was found that *M. persicae* can feed by inserting its stylets through a membrane into a tobacco plant, but Aphids rarely became infective, and infective Aphids rarely transmitted the virus, after feeding in this manner on infected and susceptible plants, respectively, although infective Aphids that penetrated a membrane could afterwards infect a plant not covered by one. Aphids did not become infective when they penetrated the deeper tissues of infected plants that had had the virus in the superficial tissues inactivated by ultraviolet radiations. The main conclusion reached is that *M. persicae* rarely becomes infective with virus Y or transmits it after the stylets penetrate beyond the first layer of plant cells.

SYLVESTER (E. S.). **Beet Mosaic and Beet Yellows Virus Transmission by the Green Peach Aphid.**—*J. Amer. Soc. Sugar Beet Tech.* **9** no. 1 pp. 56–61, 6 graphs, 6 refs. Fort Collins, Colo., 1956.

In its relation to its Aphid vector, the virus of beet yellows occupies an intermediate position between the persistent viruses, such as beet yellow net, and the non-persistent ones such as beet mosaic, and is classified by the author as semi-persistent [*cf. R.A.E.*, A **46** 53]. The differences in transmission between beet mosaic and beet yellows are illustrated from the results of tests in which *Myzus persicae* (Sulz.) was the vector. The Aphid acquires the mosaic virus in a few seconds, transmits it in a few seconds and does not retain it for much more than 30 minutes, whereas the corresponding periods for beet yellows are measured in hours [*cf.* **46** 52].

Jones (L. W.). **The Effects of some Pesticides on Microbial Activities of the Soil.**—*Bull. Utah agric. Exp. Sta.* no. 390, 17 pp., 15 refs. [Logan, Utah] 1956.

An account is given of investigations carried out in the laboratory in Utah to determine the effect of DDT, chlordane, BHC, dieldrin, aldrin, endrin, methoxy-DDT (methoxychlor), ethylene dibromide and a herbicide on soil micro-organisms [*cf. R.A.E.*, A **36** 22; **39** 349; **43** 47, 48], and the following is taken from the author's summary of the results concerning the insecticides.

None of the insecticides tested was excessively toxic to ammonifying micro-organisms (those decomposing organic matter with the liberation of ammonia). Toxicity was usually first manifested at a concentration of 0·1 per cent., which is equivalent to about a ton of insecticide per acre thoroughly distributed throughout the top 6 inches of soil, so that there is little likelihood that any of the insecticides would reach concentrations toxic to these organisms. Ethylene dibromide had a stimulating effect on ammonifying organisms over a relatively wide range of concentrations. The insecticides were considerably more toxic to nitrifying micro-organisms (those converting ammonia to nitrates). Dieldrin, aldrin and chlordane were the most toxic and inhibited at concentrations of 0·01 per cent. (approximately 200 lb. per acre), but toxic concentrations were in all cases considerably above those recommended for field application. The micro-organisms capable of oxidising sulphur compounds to sulphates showed about the same degree of resistance to the insecticides as those oxidising ammonia to nitrates. The most toxic of those tested (DDT, BHC and chlordane) began to exert their effect at about 0·01 per cent., but the results indicated that if used in recommended amounts, they can be safely used without serious injury.

No correlation was found between the numbers of micro-organisms in treated soil and the nitrifying, ammonifying and sulphur-oxidising activities of soil microbes. The addition of DDT, chlordane or BHC in concentrations that almost stopped the beneficial transformations caused considerable increase in the numbers of micro-organisms. DDT was quite stable in the soil during the first year after its addition, but less than half that added at the lowest concentration (0·125 per cent.) remained after three years in soils high in organic matter; about half of the original amount added was found after three years in sandy soils low in organic matter. Only 10 per cent. of the original amount of chlordane added at 0·01 per cent. remained at the end of three years of storage, and about one half of the BHC added at 0·01 per cent. disappeared during the same period. Ethylene dibromide stimulated nitrification over a rather wide range of concentrations as compared with the controls. The presence of organic matter tended to protect the micro-organisms against the toxic action of the insecticides used.

Papers noticed by Title only.

Thomas (I.) & Janson (H. W.). **Common Names of British Insect and other Pests.**—*Tech. Bull. Minist. Agric.* no. 6, iii + 48 [+1] pp. London, H.M.S.O., 1957. Price 7*s.* 6*d.* [Revised list: *cf. R.A.E.*, A **40** 128.]

Matsuda (R.) & Usinger (R. L.). **Insects of Micronesia. Vol. 7 no. 3. Heteroptera: Aradidae.**—pp. [3+] 117–172, 13 figs., 1 map. Honolulu, Bishop Mus., 1957. [*Cf. R.A.E.*, A **43** 345; **46** 36.]

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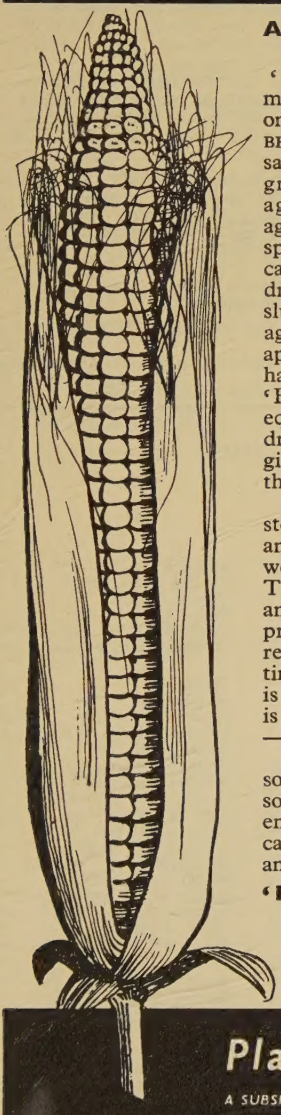

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